# HIGH ELECTRON MOBILITY TRANSISTORS,

# MICROWAVE, LOW NOISE,

# SMALL SIGNAL, GALLIUM ARSENIDE,

# BASED ON TYPE CFY66

# ESCC Detail Specification No. 5613/002

**ISSUE 1**

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Pages 1 to 23

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space components
coordination group

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| Rev. Letter | Rev. Date | Reference | CHANGE Item | Approved DCR No. |
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| | | P2. DCN | | None |
| | | P11. Para. 4.2.3 | : (c) and (d) deleted, (e) and (f) renamed and new (e) added | 221173 |
| | | P15. Table 2 DC | : Test figure column deleted | 221173 |
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| | | P21. Figure 5 | : Fig. 5(a) and 5(b) improved | 221173 |
| | | P23. Table 6 | : Change limits for tests 1 and 2 changed | 221173 |

## TABLE OF CONTENTS

Page



**TABLES**



**FIGURES**



**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 a High Electron Mobility Transistor (HEMT), Microwave, Low Noise, Small Signal, Gallium Arsenide, based on Type CFY66. It shall be read in conjunction with ESA/SCC Generic Specification No. 5010, the requirements of which are supplemented herein.

### 1.2 TYPE VARIANTS

Variants of the basic HEMTs 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 HEMTs specified herein, are as scheduled in Table 1(b).

### 1.4 PARAMETER DERATING INFORMATION

The derating information applicable to the HEMTs specified herein is shown in Figure 1.

### 1.5 PHYSICAL DIMENSIONS

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

### 1.6 FUNCTIONAL DIAGRAM

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

### 1.7 HANDLING PRECAUTIONS

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

These components are categorised as Class 1 with a Minimum Critical Path Failure Voltage of 250V.

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

| (1) VARIANT | (2) BASED ON TYPE | (3) FIGURE | (4) NOISE FIGURE $NF_{min}$ at 12 GHz (dB) | (5) ASSOCIATE GAIN $G_a$ at 12 GHz (dB) | (6) OUTPUT POWER $P_{-1dB}$ at 12 GHz (dBm) | (7) LEAD MATERIAL AND FINISH |
|---|---|---|---|---|---|---|
| 01 | CFY66-08 | 2 | 0.8 | 10 | N.A. | D2 |
| 02 | CFY66-10 | 2 | 1.0 | 9.5 | N.A. | D2 |
| 03 | CFY66-08P | 2 | 0.8 | 10 | 10 | D2 |
| 04 | CFY66-10P | 2 | 1.0 | 9.5 | 10 | D2 |

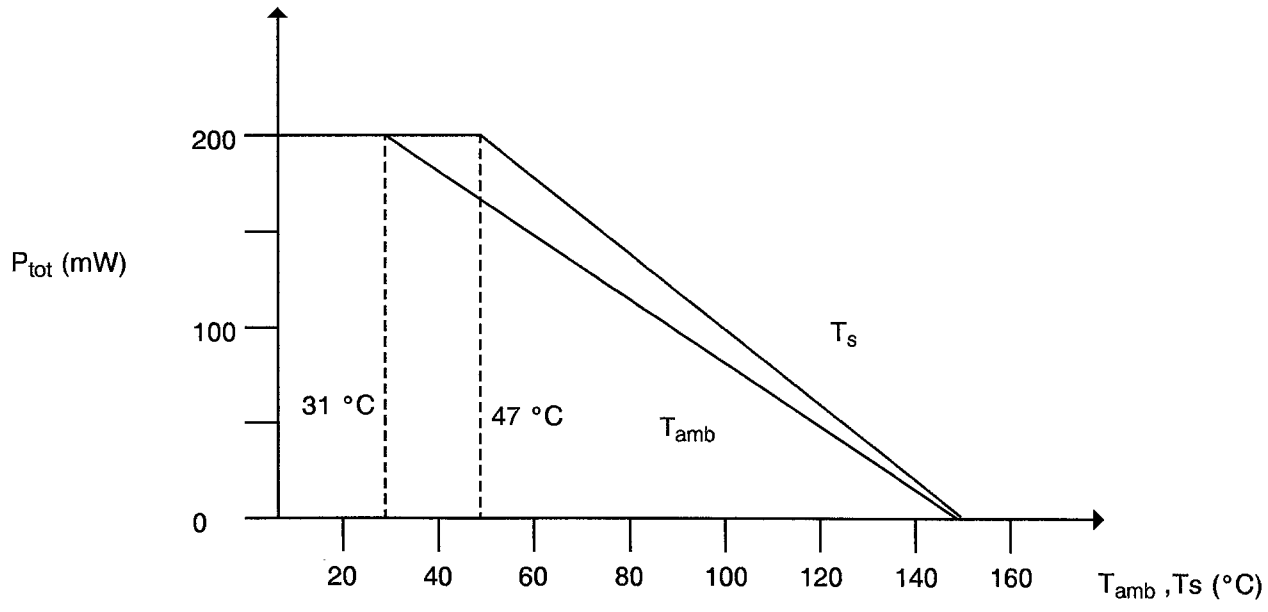
## TABLE 1(b) - MAXIMUM RATINGS

| No. | CHARACTERISTICS | SYMBOL | MAXIMUM RATINGS | UNIT | REMARKS |
|---|---|---|---|---|---|
| 1 | Drain-Source Voltage | $V_{DS}$ | 3.5 | V | |
| 2 | Drain-Gate Voltage | $V_{DG}$ | 4.5 | V | |
| 3 | Gate-Source Voltage | $V_{GS}$ | -3.0 | V | |
| 4 | Gate Forward Current | $I_{GP}$ | 2 | mA | |
| 5 | Drain Current | $I_D$ | 60 | mA | |
| 6 | Channel Temperature | $T_{ch}$ | +150 | °C | |
| 7 | Storage Temperature Range | $T_{stg}$ | -65 to +150 | °C | |
| 8 | Total Power Dissipation | $P_{tot}$ | 200 | mW | Note 1 |
| 9 | RF Input Power | $P_{in}$ | 10 | dBm | |
| 10 | Soldering Temperature | $T_{sol}$ | +230 | °C | Note 2 |

**NOTES**

1. At Ts = +47 °C ($T_s$ is measured on the source lead). For derating at Ts > + 47 °C, see Figure 1.
   At $T_{amb}$ = +31°C. For derating at $T_{amb}$ > +31°C, see Figure 1.
2. Duration 15 seconds maximum, and the same termination shall not be resoldered until 3 minutes have elapsed.

## FIGURE 1 - PARAMETER DERATING INFORMATION



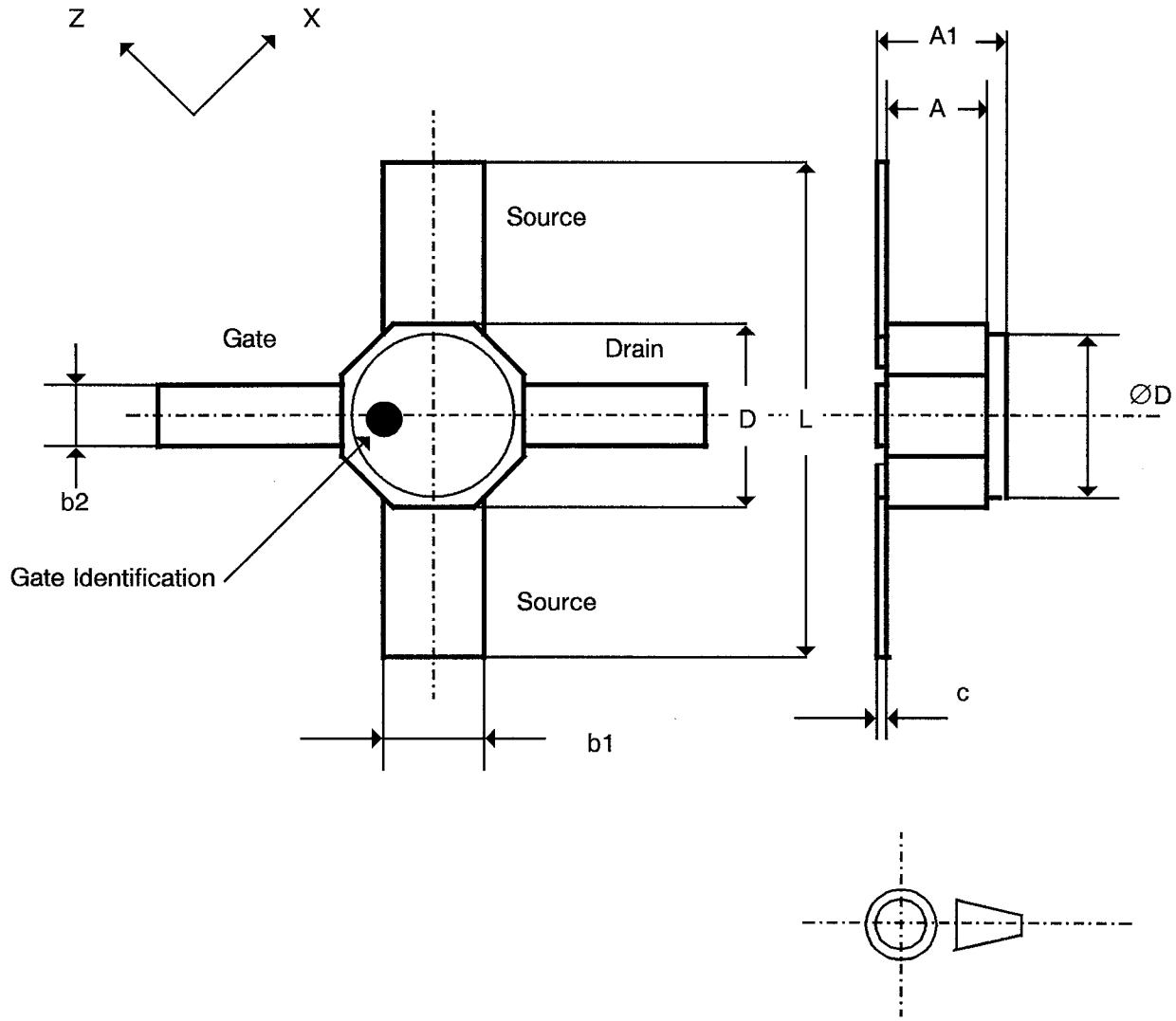

Power Dissipation versus Temperature

**NOTES**

1. $R_{thchs}$ = 515 K/W
   $R_{thchamb}$ = 595 K/W
   (Mounted on Alumina 15.0 mm × 16.7 mm × 0.7 mm)

## FIGURE 2 - PHYSICAL DIMENSIONS

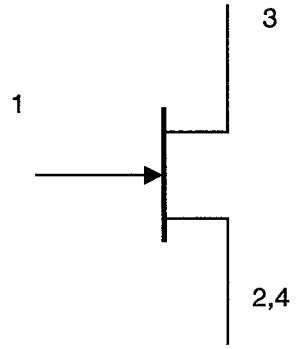
'MICRO-X" PACKAGE




| SYMBOL | MILLIMETRES | |
|---|---|---|
| | MIN. | MAX. |
| A | 0.66 | 0.86 |
| A1 | 0.85 | 1.25 |
| b1 | 0.92 | 1.12 |
| b2 | 0.40 | 0.60 |
| c | 0.07 | 0.15 |
| D | 1.68 | 1.88 |
| ØD1 | 1.55 | 1.75 |
| L | 4.0 | 4.4 |

**FIGURE 3 - FUNCTIONAL DIAGRAM**

1. Gate
2. Source
3. Drain
4. Source




**NOTES** 1. The gate is identified by the colour dot.

## 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. 5010 for Discrete Microwave Semiconductor Components.

(b) MIL-STD-750, Test Methods for Semiconductor Devices.

## 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 symbols are used:

$NF_{min}$ = Noise Figure for Optimum Noise Matching.
$G_a$ = Associated Gain for Optimum Noise Matching.
$g_m$ = Transconductance.
$\Gamma_{opt}$ = Impedance for Optimum Noise and Associated Gain.
$T_{ch}$ = Channel Temperature.
$T_s$ = Temperature on the Source Lead.
$P_{-1dB}$ = Output Power at 1 dB Gain Compression.
$P_{in}$ = Maximum RF Input Power.
$S_{xy}$ = Scattering Parameters.

## 4. REQUIREMENTS

### 4.1 GENERAL

The complete requirements for procurement of the HEMTs specified herein shall be as stated in this specification and ESA/SCC Generic Specification No. 5010 for Discrete Microwave 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

None.

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

(a) Para. 6.2, Pre-burn-in and associated Electrical Measurements: Shall not be performed.

(b) Para. 9.6, Constant Acceleration: Shall not be performed.

(c) Para. 9.14, Vibration, Variable Frequency: Shall not be performed.

(d) Para. 9.7, PIND test shall be performed in accordance with condition 'A'; it may be performed at any point after indicated position in Chart II.

(e) Para. 9.11, Dimension Check shall be performed using a gauge during RF measurements.

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

(a) Para. 9.9.1, Initial Parameter Drift Value Measurements: Parameters measured in Chart II shall not be repeated during electrical measurements at room temperature.

(b) Para. 7.1.1(b), Power Burn-in 2 and associated Electrical Measurements: Shall not be performed

(c) Para. 9.9.1, $\Delta 1$ Parameter Drift Value Measurements after HTRB shall only be performed on DC parameters (see Table 4, items 1 to 4).

(d) Para. 7.2.2, Parameter Limit Failure: After power burn-in, if $NF_{min}$ for a particular Variant drifts to the value of another variant but remains within the allowable drift limits, the component shall not be counted when determining lot rejection. Instead, that component shall be reassigned to the other Variant number related to its new $NF_{min}$ value.

(e) Para. 9.12, Radiographic Inspection: Shall not be performed.

4.2.4 Deviations from Qualification Tests (Chart IV)

(a) Subgroup I tests: Shall not be performed.

(b) Para. 9.5, Thermal Shock Test: Shall be performed in Subgroup II prior to Moisture Resistance Test.

(c) Subgroup II tests: Shall be performed on 12 components.

(d) Para. 9.20, Operating Life: Only one Operating Life Test shall be performed on 30 components.

(e) Para. 9.23, Special Testing: Shall not be performed.

4.2.5 Deviations from Lot Acceptance Tests (Chart V)

(a) Para. 9.13, Shock Test: Shall not be performed.

(b) Para. 9.14, Vibration: Shall not be performed.

(c) Para. 9.15, Constant Acceleration: Shall not be performed.

(d) Para. 9.5, Thermal shock and Para. 9.16, Moisture Resistance, shall be done in sequence on all 6 components of the Environmental/Mechanical Subgroups.

(e) Para. 9.20, Operating Life: Only one Operating Life Test shall be performed on 16 components.

(f) Para. 9.23, Special Testing: Shall not be performed.

4.3 MECHANICAL AND ENVIRONMENTAL REQUIREMENTS

4.3.1 Dimension Check

The dimensions of the HEMTs specified herein shall be checked as specified in Para. 4.2.2 of this specification.

4.3.2 Weight

The maximum weight of the HEMTs specified herein shall be 0.03 grammes .

4.3.3 Terminal Strength

The requirements for terminal strength testing are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Condition: 'A' (Tension)

(b) Force: 2.23N.

(c) Duration: 5 seconds.

4.3.4 Bond Strength

The requirements for bond strength are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Condition: 'A'.

(b) Separating Force: 0.015N minimum.

4.3.5 Die Shear

The requirements for die shear are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The test conditions shall be as follows:-

(a) Semiconductor Material Remaining: 50% minimum.

(b) Minimum Acceptable Die Shear Strength: 0.5N.

4.3.6 High Temperature Stabilisation Bake

The requirements for high temperature stabilisation bake are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The temperature to be applied shall be +150 (+0 -3) °C.

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 HEMTs specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material shall not guarantee acceptance of the finished product.

4.4.1 Case

The case shall be hermetically sealed and have a ceramic body.

4.4.2 Lead Materials and Finish

The end cap and 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 and the following paragraphs. When the component is too small to accomodate all the marking specified, as much as space permits shall be marked and the marking information, in full, shall accompany the component in its primary package.

The information to be marked and the order of precedence shall be as follows:-

(a) Terminal Identification.

(b) The SCC Component Number.

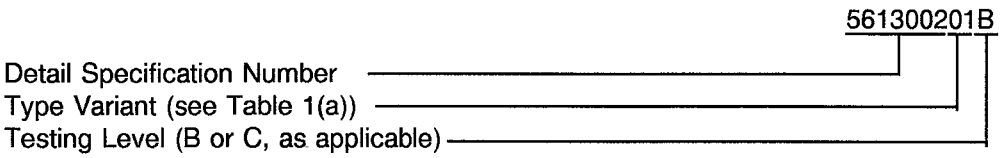
(c) Traceability Information.

4.5.2 Terminal Identification

Terminal identification shall be as shown in Figures 2 and 3 of this specification.

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 as defined in ESA/SCC Basic Specification No. 21700.

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. Unless otherwise specified, the measurements shall be performed at $T_{amb}$ = +25 ± 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. Unless otherwise specified, the measurements shall be performed at +130(-5+0) °C.

4.6.3 Circuits for Electrical Measurements

Circuits for use in performing electrical measurements listed in Table 2 of this specification are shown in Figure 4.

4.7 BURN-IN TESTS

Chart III (b): Only Burn-in 1 shall be performed.

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, the measurements shall be performed at $T_{amb}$ = +25 ± 3 °C. The parameter drift values (Δ) applicable to the scheduled parameters shall not be exceeded. In addition to these drift value requirements for a given parameter, the appropriate limit value specified in Table 2 shall not be exceeded. Furthermore, the limit failure shall be in accordance with Para. 4.2.3(f) of this specification.

4.7.2 Conditions for High Temperature Reverse Bias Burn-in

The requirements for the high temperature reverse bias burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5010. The conditions for high temperature reverse bias burn-in shall be as specified in Table 5(a) of this specification.

4.7.3 Conditions for Power Burn-in

The requirements for power burn-in are specified in Section 7 of ESA/SCC Generic Specification No. 5010. The conditions for power burn-in shall be as specified in Table 5(b) of this specification.

4.7.4 Electrical Circuits for High Temperature Reverse Bias Burn-in

Circuit for use in performing the H.T.R.B. burn-in test is shown in Figure 5(a) of this specification.

4.7.5 Electrical Circuits for Power Burn-in

Circuit for use in performing the power burn-in test is shown in Figure 5(b) of this specification.

## TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - D.C. PARAMETERS

| No. | CHARACTERISTICS | SYMBOL | MIL-STD-750 TEST METHOD | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | | MIN. | MAX. | |
| 1 | Drain Saturation Current | $I_{DSS}$ | 3413 Cond. C | $V_{DS}$ = 2.0V<br>$V_{GS}$ = 0V | 10 | 60 | mA |
| 2 | Gate Threshold Voltage | $V_{Gth}$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 1.0mA | -0.2 | -2.0 | V |
| 3 | Gate Leakage Current at pinch-off | $I_{GP}$ | 3411 Cond. A | $V_{DS}$ = 1.5V<br>$V_{GS}$ = -3.0V | - | 200 | µA |
| 4 | Transconductance | $g_m$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA | 40 | - | mS |
| 5 | Gate Leakage Current | $I_G$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA | - | -2.0 | µA |
| 6 | Gate Voltage | $V_G$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA | -1.2 | 0 | V |

## TABLE 2 - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE - A.C. PARAMETERS

| No. | CHARACTERISTICS | SYMBOL | MIL-STD-750 TEST METHOD | TEST FIG. | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | | | | MIN. | MAX. | |
| 7 | Noise Figure | $NF_{min}$ | - | 4(a) | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA<br>f = 12GHz | | Notes 1 and 5 | |
| 8 | Associated Gain | $G_a$ | - | 4(a) | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA<br>f = 12GHz | Note 2 | | |
| 9 | Output Power @ 1 dB Gain Compression | $P_{-1dB}$ | 3510 | 4(b) | $V_{DS}$ = 2.0V<br>$I_D$ = 20mA<br>f = 12GHz | Note 3 | | |
| 10 | Scattering Parameters | $S_{11}$ to $S_{22}$ | 3570 | 4(c) | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA<br>f = 1 to 12GHz | Notes 4 and 5 | | |

**NOTES**

1. See Column 4 of Table 1(a).
2. See Column 5 of Table 1(a).
3. See Column 6 of Table 1(a). Not measured for Variants 01 and 02.
4. Typical parameters measured on a sample basis and supplied for information purpose only.
5. See Table 2 - Scattering and noise parameters (see Page 16).

## TABLE 2 - ELECTRICAL MEASURMENTS AT ROOM TEMPERATURE - A.C. PARAMETERS

## SCATTERING AND NOISE PARAMETERS (NOTE 4)

| f (GHz) | $S_{11}$ | | $S_{12}$ | | $S_{21}$ | | $S_{22}$ | | $R_n$ (Ω) | $\Gamma_{opt}$ | | $NF_{min}$ (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | magn. | angle | magn. | angle | magn. | angle | magn. | angle | | magn. | angle | |
| 1 | 0.99 | -20.6 | 0.026 | 70.2 | 4.451 | 160.5 | 0.64 | -15.8 | 17.8 | 0.77 | 16 | 0.27 |
| 2 | 0.96 | -38.6 | 0.046 | 61.1 | 4.282 | 143.5 | 0.63 | -29.3 | 16.5 | 0.72 | 30 | 0.31 |
| 3 | 0.92 | -57.2 | 0.065 | 49.2 | 4.148 | 126.2 | 0.60 | -42.8 | 15.3 | 0.672 | 43 | 0.35 |
| 4 | 0.88 | -77.1 | 0.083 | 37.2 | 3.979 | 108.4 | 0.55 | -56.9 | 13.7 | 0.634 | 57 | 0.38 |
| 5 | 0.83 | -94.8 | 0.094 | 25.2 | 3.727 | 92.6 | 0.52 | -70.3 | 12 | 0.604 | 71 | 0.42 |
| 6 | 0.79 | -110.5 | 0.1 | 14.2 | 3.444 | 77.5 | 0.50 | -83 | 10 | 0.578 | 85 | 0.46 |
| 7 | 0.76 | -123.9 | 0.106 | 5.7 | 3.206 | 63.5 | 0.49 | -93.9 | 8.15 | 0.558 | 100 | 0.50 |
| 8 | 0.72 | -136.8 | 0.111 | -2.7 | 3.029 | 50.2 | 0.48 | -103.2 | 6.30 | 0.541 | 114 | 0.55 |
| 9 | 0.69 | -149.9 | 0.113 | -11 | 2.907 | 37.9 | 0.46 | -110 | 4.74 | 0.528 | 128 | 0.60 |
| 10 | 0.67 | -164.6 | 0.119 | -19.5 | 2.845 | 25.2 | 0.43 | -118.1 | 3.45 | 0.517 | 143 | 0.65 |
| 11 | 0.65 | 179.1 | 0.121 | -28.1 | 2.787 | 11 | 0.39 | -129.8 | 2.58 | 0.506 | 157 | 0.70 |
| 12 | 0.63 | 163.8 | 0.120 | -36.9 | 2.699 | -2.8 | 0.37 | -143 | 2.16 | 0.496 | 171 | 0.74 |
| 13 | 0.61 | 150.5 | 0.120 | -46.4 | 2.614 | -15.8 | 0.37 | -153.2 | 2.27 | 0.485 | -175 | 0.79 |
| 14 | 0.59 | 137.5 | 0.119 | -54.6 | 2.584 | -28 | 0.36 | -161.9 | 2.88 | 0.472 | -160 | 0.85 |
| 15 | 0.58 | 120.8 | 0.118 | -65.6 | 2.550 | -42.1 | 0.34 | -172.1 | 3.99 | 0.457 | -146 | 0.89 |
| 16 | 0.58 | 104.3 | 0.117 | -75.9 | 2.484 | -56.3 | 0.33 | -177.6 | 5.59 | 0.437 | -132 | 0.95 |
| 17 | 0.58 | 89 | 0.115 | -87.1 | 2.461 | -70.8 | 0.33 | 168.7 | 7.63 | 0.415 | -118 | 1.00 |
| 18 | 0.58 | 73.6 | 0.116 | -100.0 | 2.456 | -85.6 | 0.31 | 160.3 | 9.96 | 0.389 | -102 | 1.06 |

**NOTES**: See page 15.

**TABLE 3 - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURES +130 (-5+0) C**

| No. | CHARACTERISTICS | SYMBOL | MIL-STD-750 TEST METHOD | TEST CONDITIONS | LIMITS | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | | MIN. | MAX. | |
| 2 | Gate Threshold Voltage | $V_{Gth}$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 1.0mA | -0.2 | -2.0 | V |
| 3 | Gate Leakage Current at pinch-off | $I_{GP}$ | 3411 Cond A | $V_{DS}$ = 1.5V<br>$V_{GS}$ = -3.0V | - | 200 | µA |
| 4 | Transconductance | $g_m$ | 3403 | $V_{DS}$ = 2.0V<br>$I_D$ = 10mA | 30 | - | mS |

**TABLE 4 - PARAMETER DRIFT VALUES**

| No. | CHARACTERISTICS | SYMBOL | SPEC.AND/OR TEST METHOD | TEST CONDITIONS | CHANGE LIMITS (Δ) | UNIT |
|---|---|---|---|---|---|---|
| 1 | Drain Saturation Current | $I_{DSS}$ | As per Table 2 | As per Table 2 | ±2.5 (1) | mA |
| 2 | Gate Threshold Voltage | $V_{Gth}$ | As per Table 2 | As per Table 2 | ±0.05 (1) | V |
| 3 | Gate Leakage Current at Pinch-off | $I_{GP}$ | As per Table 2 | As per Table 2 | ±50 (1) | µA |
| 4 | Transconductance | $g_m$ | As per Table 2 | As per Table 2 | ±2.5 (1) | mS |
| 7 | Noise Figure | $NF_{min}$ | As per Table 2 | As per Table 2 | ±0.1 (1) | dB |
| 8 | Associated Gain | $G_a$ | As per Table 2 | As per Table 2 | ±0.3 (1) | dB |

**NOTES** 1. Δ1 = Δ2

## FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS

FIGURE 4(a) - NOISE FIGURE

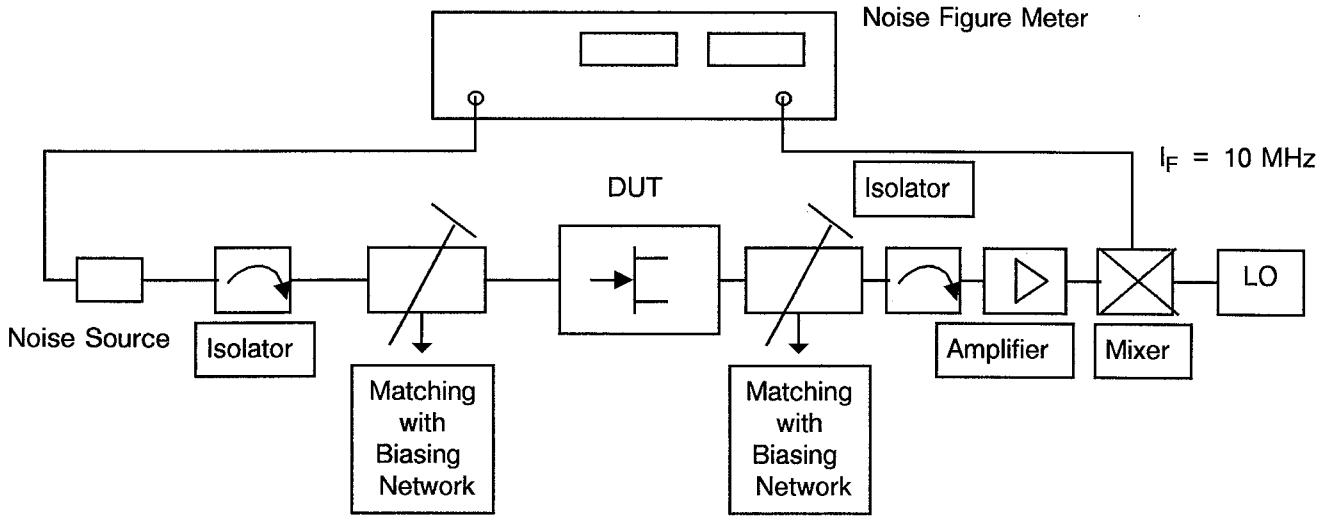


**FIGURE 4 - CIRCUITS FOR ELECTRICAL MEASUREMENTS**

FIGURE 4(b) - OUTPUT POWER

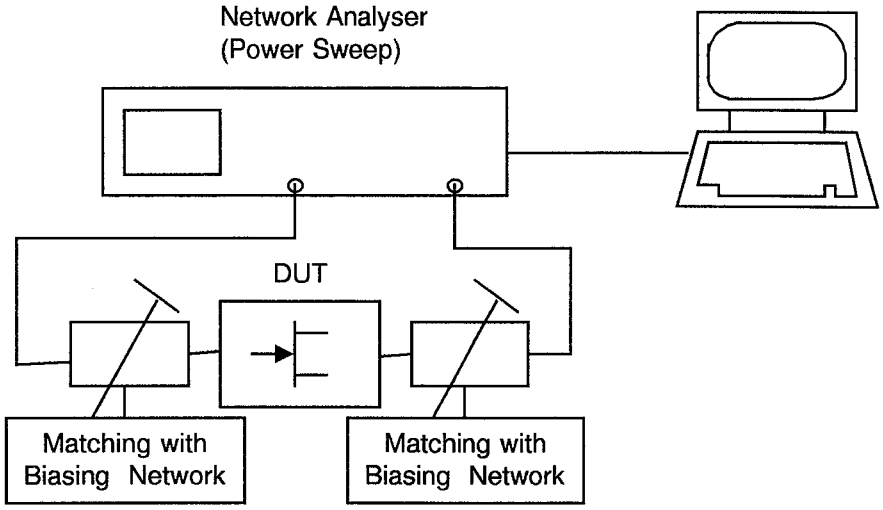
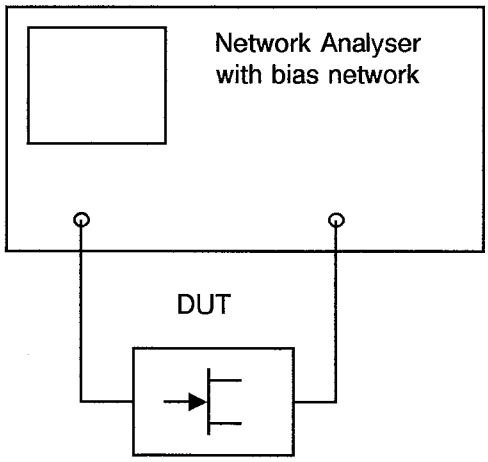



FIGURE 4(c) - SCATTERING PARAMETERS



## TABLE 5(a) - CONDITIONS FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN

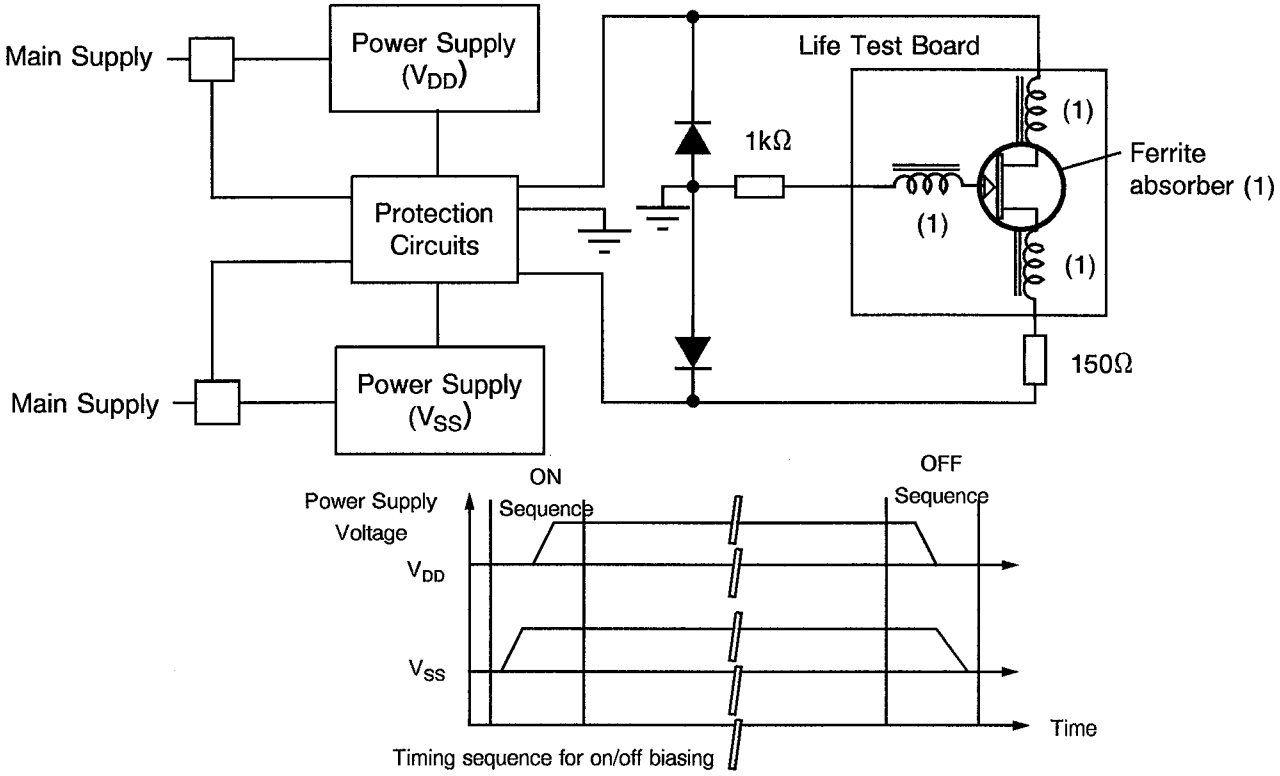
| No. | CHARACTERISTICS | SYMBOL | CONDITIONS | UNIT |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | +150(+0 -3) | °C |
| 2 | Drain Source Voltage | $V_{DS}$ | 1.5 (+0 -0.2) | V |
| 3 | Gate Source Voltage | $V_{GS}$ | -3.0 (+0.3 -0) | V |

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

| No. | CHARACTERISTICS | SYMBOL | CONDITIONS | UNIT |
|---|---|---|---|---|
| 1 | Ambient Temperature | $T_{amb}$ | +100(+0 -3) | °C |
| 2 | Drain Source Voltage | $V_{DS}$ | +2.5 (+0 -0.2) | V |
| 3 | Drain Current | $I_{DS}$ | +30 (+0 -3) | mA |

**NOTES**: 1. For $R_{thchamb}$: 660 K/W on burn-in board.

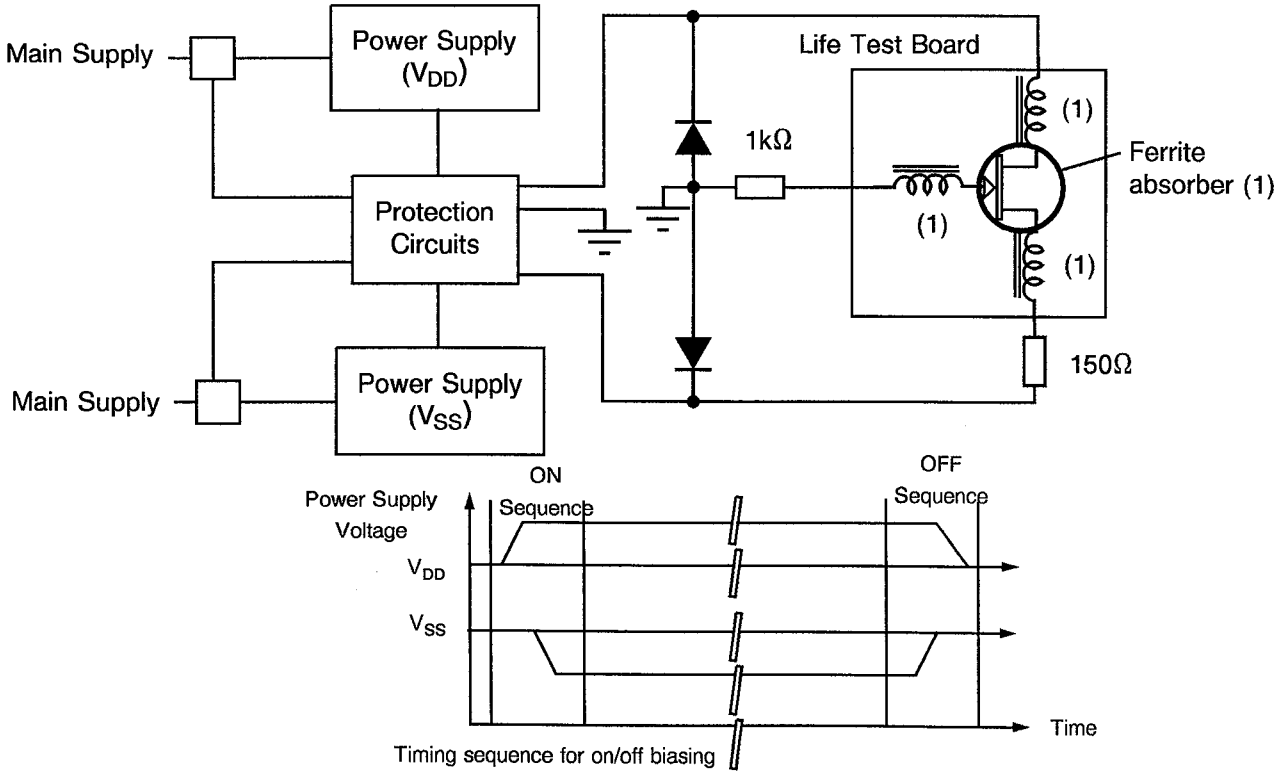
**FIGURE 5(a) - ELECTRICAL CIRCUIT FOR HIGH TEMPERATURE REVERSE BIAS BURN-IN**




**NOTES**

1. Damping elements against self oscillation.

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




**NOTES**

1. Damping elements against self oscillation.

4.8 ENVIRONMENTAL AND ENDURANCE TESTS (CHARTS IV AND V OF ESA/SCC GENERIC SPECIFICATION NO. 5010)

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. Unless otherwise stated, the measurements shall be performed at $T_{amb}$ = +25 ± 3 °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 tests are scheduled in Table 6. Unless otherwise stated, the measurements shall be performed at $T_{amb}$ = +25 ± 3 °C.

4.8.3 Conditions for Operating Life Tests (Part of Endurance Testing)

The requirements for operating life testing are specified in Section 9 of ESA/SCC Generic Specification No. 5010. The conditions for operating life testing are specified in Table 5(b) of this specification.

4.8.4 Electrical Circuits for Operating Life Tests

The circuit to be used for performance of the operating life test shall be the same as shown in Figure 5(b) for Power Burn-in.

4.9 RADIATION TESTING

Not applicable.

4.10 SPECIAL TESTING

Not applicable.

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

| No. | CHARACTERISTICS | SYMBOL | SPEC. AND/OR TEST METHOD | TEST CONDITIONS | CHANGE LIMITS | UNIT |
|---|---|---|---|---|---|---|
| 1 | Drain Saturation Current | $I_{DSS}$ | As per Table 2 | As per Table 2 | ± 3.0 | mA |
| 2 | Gate Threshold Voltage | $V_{Gth}$ | As per Table 2 | As per Table 2 | ±0.06 | V |
| 3 | Gate Pinch-off Current | $I_{GP}$ | As per Table 2 | As per Table 2 | ±50 | µA |
| 4 | Transconductance | $g_m$ | As per Table 2 | As per Table 2 | ± 2.5 | mS |
| 7 | Noise Figure | $NF_{min}$ | As per Table 2 | As per Table 2 | ± 0.1 | dB |
| 8 | Associated Gain | $G_a$ | As per Table 2 | As per Table 2 | ± 0.4 | dB |
| 9 | Output Power @ 1 dB Gain Compression | $P_{-1dB}$ | As per Table 2 | As per Table 2 | ± 0.4 | dB |