

## S-Band Radar Transistor

The high power pulsed radar transistor device part number IB2226MH15 is designed for S-Band radar systems operating over the instantaneous bandwidth of 2.25-2.55 GHz. While operating in class C mode this common base device supplies a minimum of 15 watts of peak pulse power under the conditions of 200 $\mu$ s pulse width and 10% duty cycle. All devices are 100% screened for large signal RF parameters, including power gain compression. Excellent spectral stability into output mismatch over a broad input power range make it ideal for use in reliable high power solid state transmitters.



### Silicon Bipolar

- Ultra-high  $f_T$

### Class C Operation

- High Efficiency

### Common Base Configuration

- Single Power Supply

### Gold Metal

- Maximum Reliability

### Emitter Ballasting

- Optimum Thermal Distribution

### Internal Impedance Matching

- Ease of Use
- Ultra-low Loss Design

### Be0 Package

- Solder Seal Hermeticity
- Unmatched Thermal Reliability

### RF Test Fixture

- Broadband
- Matched to 50 $\Omega$
- Long-term Correlation
- 100% Device RF Screening
- No External Tuning Allowed
- Micro-strip structure on soft pc board with dielectric constant 10.2

*TYPICAL DATA    TYPICAL DATA    TYPICAL DATA    TYPICAL DATA*

| Test Sequence Name | Freq (GHz) | PW (us) | Duty (%) | Vcc (V) | P <sub>IN</sub> (W) | IRL (dB) | P <sub>OUT</sub> (W) | G <sub>P</sub> (dB) | I <sub>C</sub> (A) | N <sub>C</sub> (%) | Droop (dB) | VSWR 1.5:1 | VSWR 2:1 |
|--------------------|------------|---------|----------|---------|---------------------|----------|----------------------|---------------------|--------------------|--------------------|------------|------------|----------|
| +0.75dB            | 2.250      | 200     | 10       | 36.0    | 2.38                | --       | --                   | --                  | --                 | --                 | --         | P          | --       |
| Nominal            | 2.250      | 200     | 10       | 36.0    | 2.00                | -9       | 22                   | 10.5                | 1.43               | 43                 | -0.25      | --         | P        |
| +0.75dB            | 2.400      | 200     | 10       | 36.0    | 2.38                | --       | --                   | --                  | --                 | --                 | --         | P          | --       |
| Nominal            | 2.400      | 200     | 10       | 36.0    | 2.00                | -16      | 21                   | 10.2                | 1.36               | 42                 | -0.28      | --         | P        |
| +0.75dB            | 2.550      | 200     | 10       | 36.0    | 2.38                | --       | --                   | --                  | --                 | --                 | --         | P          | --       |
| Nominal            | 2.550      | 200     | 10       | 36.0    | 2.00                | -11      | 22                   | 10.4                | 1.45               | 42                 | -0.29      | --         | P        |

**MAXIMUM RATINGS**

| Screen | Parameter                                    | Symbol    | Min | Max  | Units | Test Conditions |
|--------|--|-----------|-----|------|-------|-----------------|
| BD     | Collector-Emitter Voltage                    | $V_{CES}$ | --  | 70   | V     | $V_{BE}=0V$     |
| BD     | Storage Temperature Range                    | $T_{STG}$ | -65 | +150 | °C    | --              |
| BD     | Operating Junction Temperature Range         | $T_J$     | -55 | +200 | °C    | --              |
| Note   | Screen 'BD' = parameter qualified By Design. |           |     |      |       |                 |

**THERMAL CHARACTERISTICS**

| Screen | Parameter                                    | Symbol       | Min | Max | Units | Test Conditions  |
|--------|--|--------------|-----|-----|-------|--|
| BD     | Thermal Resistance                           | $R_{TH(JC)}$ | --  | 1.7 | °C/W  | $V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{OUT}= 15W.$ |
| Note   | Screen 'BD' = parameter qualified By Design. |              |     |     |       |  |

**PROCESSING SPECIFICATIONS**

| Screen | Parameter  | Symbol | Min | Max | Units | Test Conditions                               |
|--------|--|--------|-----|-----|-------|---|
| 100%   | DC Wafer Probe   | --     | --  | --  | --    | Per Integra specification.                    |
| Q1     | Wafer DC and RF Qualification  | --     | --  | --  | --    | Per Integra specification.                    |
| LM     | Wire Bond Strength   | --     | --  | --  | --    | Line monitor per Integra specification.       |
| 100%   | Pre-cap visual inspection  | --     | --  | --  | --    | Per Integra specification                     |
| 100%   | Gross leak test  | --     | --  | --  | --    | MIL-STD-750D, Method 1071.6, Test Condition C |
| Note   | Screen 'Q1' = parameter is qualified by assembly and test of 3 pieces minimum per wafer. |        |     |     |       |   |
| Note   | Screen 'LM' = parameter is qualified by assembly line monitor.                           |        |     |     |       |   |

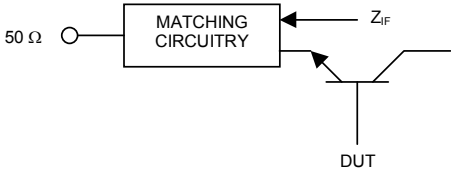
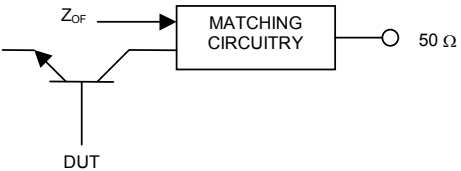
**DC ELECTRICAL CHARACTERISTICS**

| Screen | Parameter                                   | Symbol     | Min | Max | Units | Test Conditions                                    |
|--------|---|------------|-----|-----|-------|--|
| 100%   | Collector-Emitter Breakdown Voltage         | $BV_{CES}$ | 70  | --  | V     | $I_C = 10mA, V_{BE} = 0V, T_F = 25\pm5^\circ C.$   |
| 100%   | Zero Base Voltage Collector Leakage Current | $I_{CES}$  | --  | 1.5 | mA    | $V_{CE} = 36V, V_{BE} = 0V, T_F = 25\pm5^\circ C.$ |
| 100%   | DC Current Gain                             | $H_{FE}$   | 10  | 150 | --    | $V_{CE} = 5V, I_C = 100mA, T_F = 25\pm5^\circ C.$  |

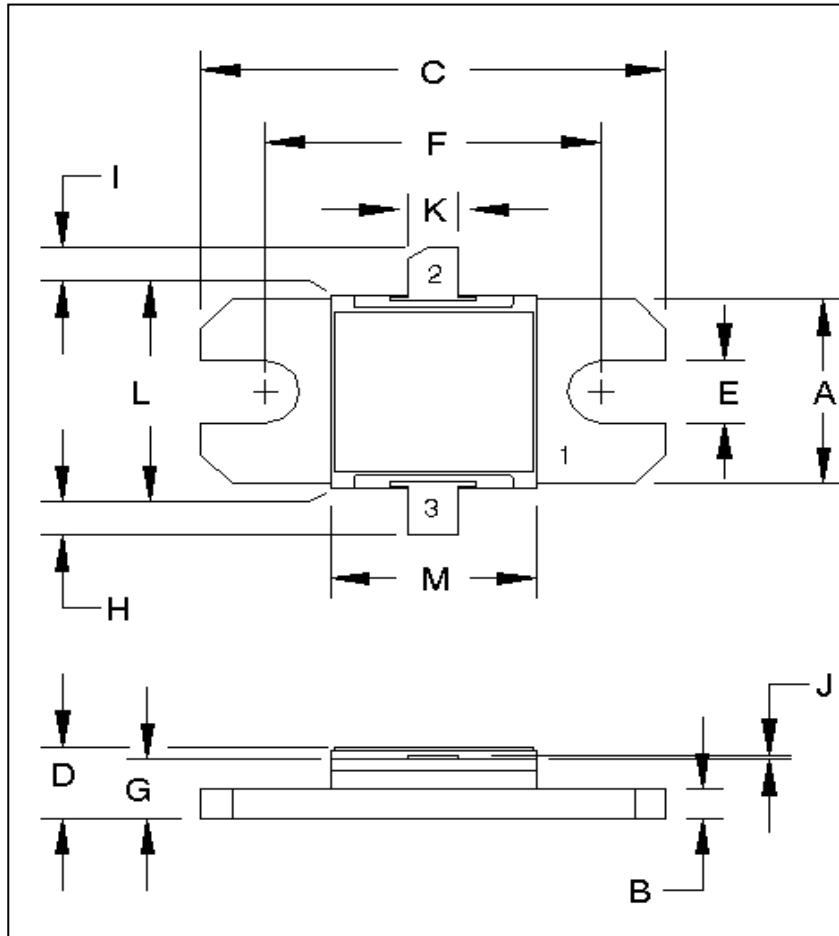
**RF ELECTRICAL CHARACTERISTICS**

| Screen | Parameter  | Symbol | Min  | Max  | Units | Test Conditions  |
|--------|--|--------|------|------|-------|--|
| 100%   | Input Return Loss  | IRL    | -18  | -7   | dB    | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$  |
| 100%   | Output Power   | $P_O$  | 15   | 30   | W     | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$  |
| 100%   | Collector Efficiency ( $P_O/I_C/V_{CC}$ )  | $N_C$  | 35   | 100  | %     | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$  |
| 100%   | Pulse Amplitude Droop  | D      | -0.6 | +0.2 | dB    | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$  |
| 100%   | Stability into 1.5:1 VSWR with +0.75dB overdrive   | VSWR-S | --   | --   | --    | Repeat $P_O$ with $P_{IN}$ increased by 0.75dB. Rotate 1.5:1 output VSWR through 360° phase. No oscillatory or pulse break-up characteristics allowed on detected output pulse. All non-harmonically related signals must be at least -50 dBc. |
| 100%   | 2:1 Load Mismatch Tolerance  | LMT    | --   | --   | --    | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$ Rotate 2:1 output VSWR through 360° phase. Post test $P_O$ = Pre test $P_O \pm 0.2$ dB.  |
| BD     | Pulse Risetime   | RT     | --   | 150  | ns    | $V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$ Measure between 10% and 90% detected power points.   |
| Note   | $V1 = 36V \pm 1V; PW1 = 200\mu s; DF1 = 10\%; P_{IN1} = P_{IN2} = P_{IN3} = 2W; F1 = 2.25 \text{ GHz}, F2 = 2.40 \text{ GHz}, F3 = 2.55 \text{ GHz}, T_{F1} = 25 \pm 5^\circ C.$ |        |      |      |       |  |
| Note   | $T_F$ = Device flange temperature.   |        |      |      |       |  |
| Note   | Screen 'BD' = parameter qualified By Design.   |        |      |      |       |  |

**RF TEST FIXTURE IMPEDANCE CHARACTERISTICS**

| Frequency (MHz)      | $Z_{IF} (\Omega)$   | $Z_{OF} (\Omega)$  |
|----------------------|---|--|
| 2.25                 | 5.2 - j9.9  | 7.9 + j8.6   |
| 2.40                 | 4.5 - j8.9  | 8.2 + j5.7   |
| 2.55                 | 4.0 - j7.8  | 6.4 + j4.7   |
| Impedance Definition |  |  |

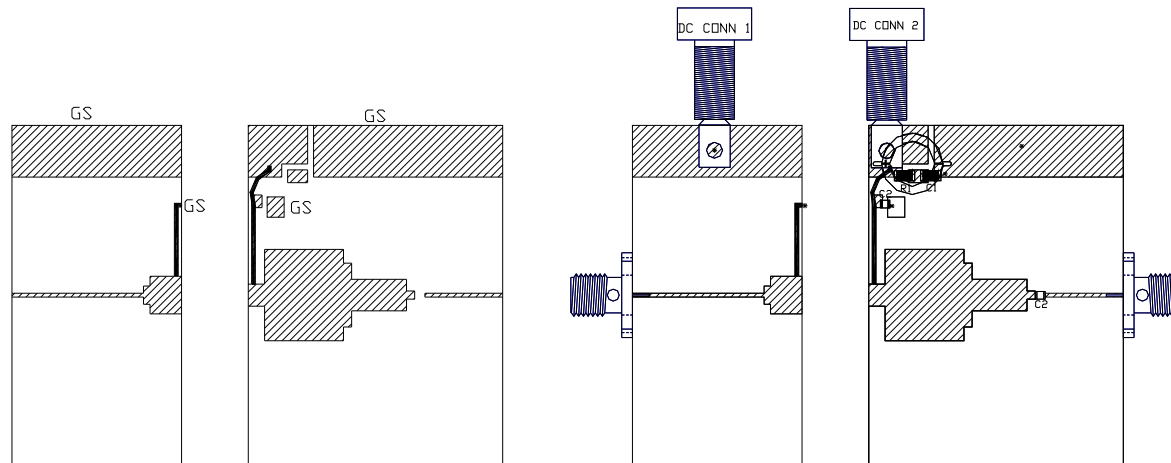
**PACKAGE DIMENSIONAL OUTLINE DRAWING**



| DIM | INCHES |       | MILLIMETERS |       |
|-----|--------|-------|-------------|-------|
|     | MIN    | MAX   | MIN         | MAX   |
| A   | 0.380  | 0.390 | 9.65        | 9.91  |
| B   | 0.058  | 0.062 | 1.47        | 1.57  |
| C   | 0.895  | 0.905 | 22.73       | 22.99 |
| D   | 0.157  | 0.177 | 3.99        | 4.50  |
| E   | 0.125  | 0.135 | 3.18        | 3.43  |
| F   | 0.645  | 0.655 | 16.38       | 16.64 |
| G   | 0.112  | 0.132 | 2.84        | 3.35  |
| H   | 0.095  | 0.105 | 2.41        | 2.67  |
| I   | 0.095  | 0.105 | 2.41        | 2.67  |
| J   | 0.003  | 0.005 | 0.08        | 0.13  |
| K   | 0.095  | 0.105 | 2.41        | 2.67  |
| L   | 0.395  | 0.405 | 10.03       | 10.29 |
| M   | 0.395  | 0.405 | 10.03       | 10.29 |

| PIN |           |
|-----|-----------|
| 1   | BASE      |
| 2   | COLLECTOR |
| 3   | EMITTER   |

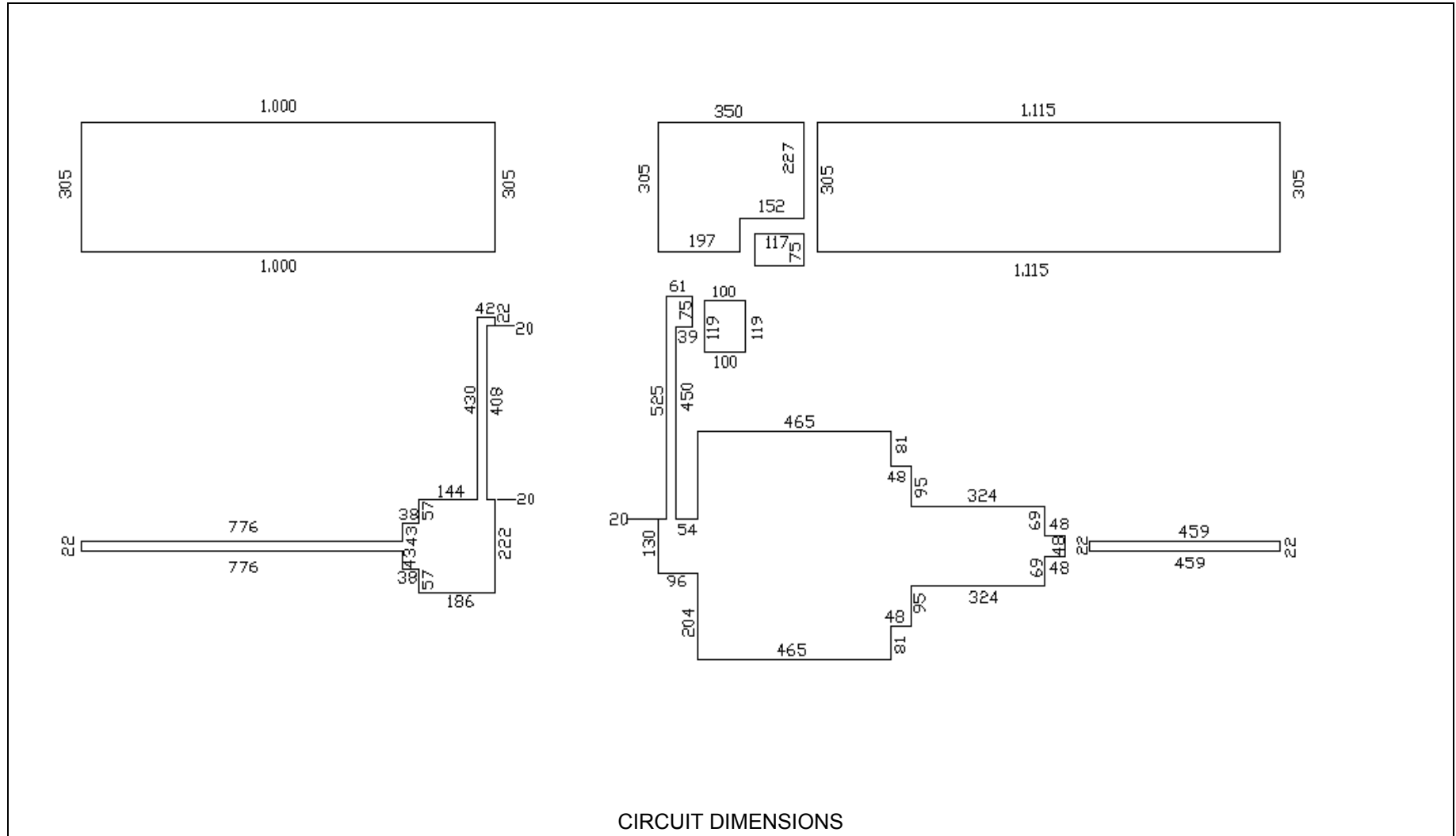
**RF TEST FIXTURE**



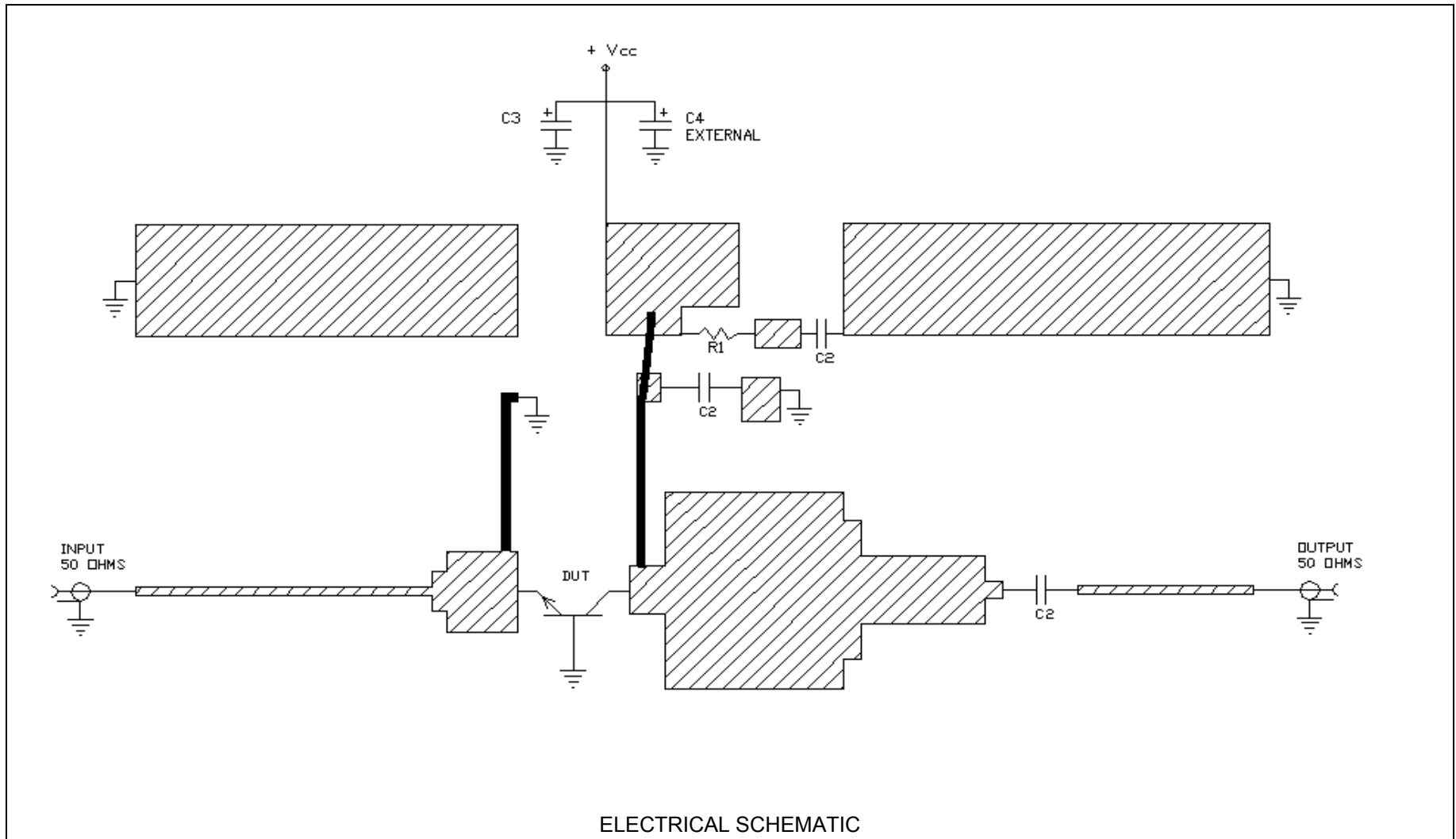
| COMPONENT               | DESCRIPTION                                     |
|-------------------------|---|
| DUT                     | TRANSISTOR #IB2226MH15, MOUNT HARD TO THE RIGHT |
| PC BOARD                | ROGERS #R0 6010.2 LM .025" 2 oz Cu              |
| C1                      | SNUB CAPACITOR .1uF                             |
| C2                      | CHIP CAPACITOR ATC100A-39pF - (2 PLACES)        |
| C3                      | ELECTROLYTIC CAPACITOR 68uF / 63V               |
| R1                      | SNUB RESISTOR 6.31 Ohms                         |
| JUMPER WIRE             | JUMPER WIRE (1PLACE)                            |
| BIAS LINE WIRE          | BIAS LINE WIRE (2 PLACES)                       |
| GS (5 PLACES)           | GROUND SHIM, COPPER, TH=0.001"                  |
| CONN 1, CONN 2          | SMA CONNECTOR, QS #2052-5636-01                 |
| INPUT PC BOARD CARRIER  | 2 INCH BRASS-03 (1.0")                          |
| OUTPUT PC BOARD CARRIER | 2 INCH BRASS-04 (1.5")                          |
| TRANSISTOR CARRIER      | 2 INCH COPPER-02                                |
| TRANSISTOR CLAMP        | NORLY CLAMP-02                                  |
| ALUMINUM HEATSINK       | 2 INCH HEAT SINK-09                             |
| DC CONN 1               | BANANA JACK, BLACK 1 PLACE                      |
| DC CONN 2               | BANANA JACK, RED 2 PLACES                       |
| NOTE                    | FIXTURE HARDWARE DRAWINGS AVAILABLE ON REQUEST  |

**ASSEMBLY AND PARTS LIST**

**RF TEST FIXTURE**



**RF TEST FIXTURE**



**DEFINITIONS**

| <b>Data Sheet Status</b>  |   |
|---|---|
| Proposed Specification  | This data sheet contains proposed specifications.                                   |
| Preliminary Specification   | This data sheet contains specifications based on preliminary measurements and data. |
| Product Specification   | This data sheet contains final product specifications.                              |
| <b>Maximum Ratings</b>  |   |
| Stress above one or more of the maximum ratings may cause permanent damage to the device. These are maximum ratings only. Operation of the device at these or at any other conditions above those given in the characteristics sections of the specification is not implied. Exposure to maximum values for extended periods of time may affect device reliability. |   |

**WARNING**

| <b>Product and environmental safety - toxic materials</b>  |
|--|
| This product contains beryllium oxide. The product is entirely safe provided that the BeO base is not damaged. All persons who handle, use or dispose of this product should be aware of its nature and of the necessary safety precautions. After use, dispose of as chemical or special waste according to the regulations applying at the location of the user. It must never be thrown out with general or domestic waste. |

**DISCLAIMER**

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