

S-Band Radar Transistor

The high power pulsed radar transistor device part number IB2931MH155 is designed for S-Band radar systems operating over the instantaneous bandwidth of 2.9-3.1 GHz. While operating in class C mode this common base device supplies a minimum of 155 watts of peak pulse power under the conditions of 100 μ s pulse width and 10% duty cycle over the frequency range of 2.9-3.1 GHz. 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. The test fixture includes a passive amplitude sloping network to insure that the device is not overdriven as the operating frequency decreases.



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

- Unmatched Thermal Reliability
- Solder Seal Hermeticity

RF Test Fixture

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

US Patent Number

- US 6181200B1
- US 6331931B1
- US 8344809B2

TYPICAL DATA TYPICAL DATA TYPICAL DATA TYPICAL DATA

Test Sequence Name	Freq (GHz)	Pin (W)	IRL (dB)	Pout (W)	Gp (dB)	OPC (dB)	OPF (dB)	Ic (A)	Nc (%)	Droop (dB)	VSWR-S	LMT
OPC	2.900	22.4	--	--	--	0.37	--	--	--	--	--	--
Nominal	2.900	20.0	-15	215	10.3	--	0.72	12.50	48	-0.25	--	P
1.5:1 Stability/OD	2.900	23.5	--	--	--	--	--	--	--	--	S	--
OPC	3.000	22.4	--	--	--	0.32	--	--	--	--	--	--
Nominal	3.000	20.0	-20	204	10.1	--	--	12.00	47	-0.25	--	P
1.5:1 Stability/OD	3.000	23.5	--	--	--	--	--	--	--	--	S	--
OPC	3.100	22.4	--	--	--	0.13	--	--	--	--	--	--
Nominal	3.100	20.0	-20	182	9.6	--	--	11.10	46	-0.12	--	P
1.5:1 Stability/OD	3.100	23.5	--	--	--	--	--	--	--	--	S	--

MAXIMUM RATINGS

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
BD	Collector-Emitter Voltage	V_{CES}	--	70	V	--
BD	Storage Temperature Range	T_{STG}	-55	+200	°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	$R_{TH(JC)}$		0.25	°C/W	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{OUT}=155W, N_C=38\%$.
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, 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}	65	--	V	$I_C=30mA, V_{BE}=0V, T_F=25\pm5^\circ C$.
100%	Zero Base Voltage Collector Leakage Current	I_{CES}	--	6.0	mA	$V_{CE}=30V, V_{BE}=0V, T_F=25\pm5^\circ C$.
100%	DC Current Gain	H_{FE}	10	120	--	$V_{CE}=5V, I_C=0.1A, T_F=25\pm5^\circ C$.

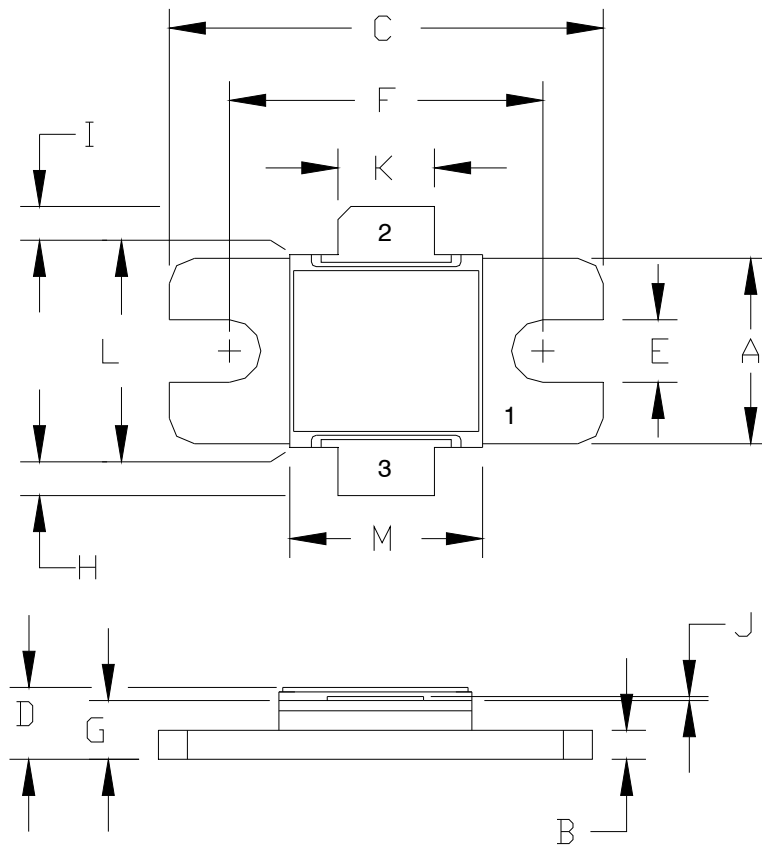
RF ELECTRICAL CHARACTERISTICS

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
100%	Input Return Loss	IRL	-30	-7	dB	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, F=F1, F2, F3$
100%	Output Power	P_{OUT}	155	225	W	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, F=F1, F2, F3$
100%	Collector Efficiency ($P_o/I_c/V_{CC}$)	N_c	38	60	%	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, F=F1, F2, F3$
100%	Pulse Amplitude Droop	D	-0.80	+0.50	dB	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, F=F1, F2, F3$
100%	Output Power Compression = $10 \cdot \text{LOG}(P_{OC}/P_o)$	OPC	+0.02	+0.48	dB	P_{OC} measured with P_{IN} increased by 0.5dB at $F=F1, F2, F3$
100%	Output Power Flatness = $10 \cdot \text{LOG}(P_{OMAX}/P_{OMIN})$	OPF	--	0.75	dB	Calculate from P_o at each frequency $F1, F2, F3$.
100%	Delta Insertion Phase Variation	d-IP	-30	+30	Deg	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN3}, F=F2$, Mark in 5° increments. See note 3.
100%	Stability into 1.5:1 VSWR with +0.7dB overdrive	VSWR-S	--	--	--	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3$. Repeat P_o with P_{IN} increased by 0.70dB. Rotate 1.5:1 output VSWR through 360° of phase. No oscillatory or pulse break-up characteristics are allowed on the detected output pulse. All non-harmonically related signals must be at least -65 dBc.
100%	2:1 Load Mismatch Tolerance	LMT	--	--	--	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3$. Rotate 2:1 output VSWR through 360° of phase. Post test $P_o = \text{Pre test } P_o \pm 5W$.
BD	Risetime	RT	--	150	ns	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{IN}=P_{IN1}, F=F1, F2, F3$ Measure at 10 & 90% detected power points.
Note 1	$V1 = 36V; PW1 = 100\mu s; DF1 = 10\%; P_{IN1} = P_{IN2} = P_{IN3} = 20W; F1 = 2.90 \text{ GHz}, F2 = 3.00 \text{ GHz}, F3 = 3.10 \text{ GHz}$.					
Note 2	$T_F = \text{Device flange temperature}$. Screen 'BD' = parameter qualified By Design.					
Note 3	Parts are binned and marked in 5 degree increments for Insertion Phase IP: ITI-1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12.					

RF TEST FIXTURE IMPEDANCE CHARACTERISTICS

Frequency (MHz)	$Z_{IF} (\Omega)$	$Z_{OF} (\Omega)$
2.90	4.73 -j6.87	2 -j5.5
3.00	4.29 -j5.79	2 -j5.2
3.10	4.14 -j4.77	1.95 -j4.96
Impedance Definition		

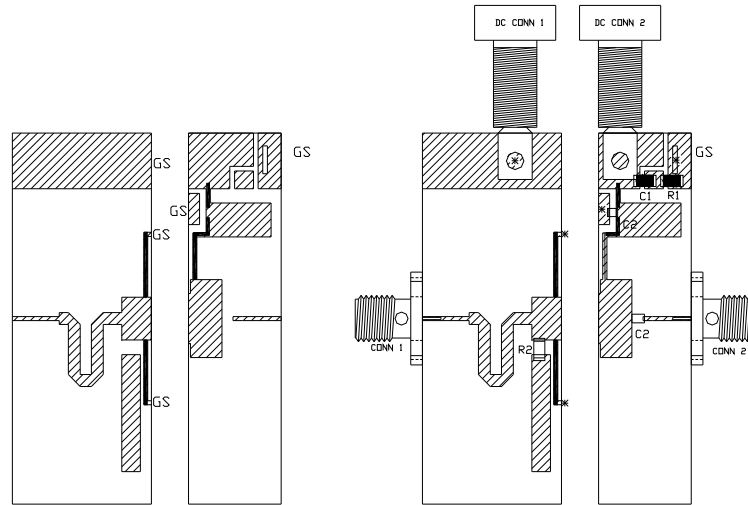
PACKAGE DIMENSIONAL OUTLINE DRAWING



DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.380	0.390	9.65	9.91
B	0.055	0.065	1.40	1.65
C	0.895	0.905	22.73	22.99
D	0.150	0.180	3.81	4.57
E	0.125	0.135	3.18	3.43
F	0.645	0.655	16.38	16.64
G	0.110	0.130	2.79	3.30
H	0.125	0.129	3.17	3.28
I	0.125	0.129	3.17	3.28
J	0.003	0.005	0.08	0.13
K	0.195	0.205	4.95	5.21
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

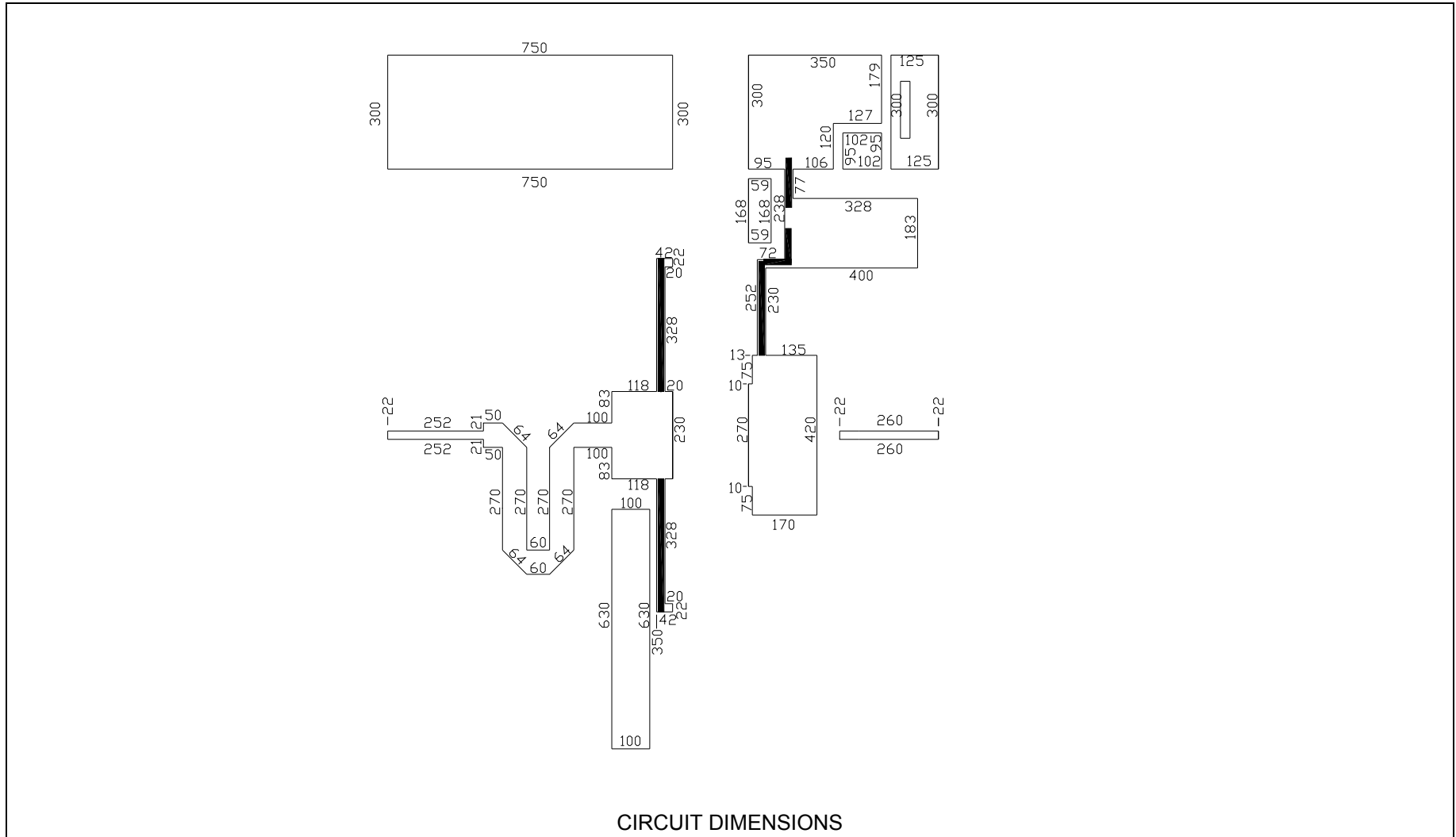
RF TEST FIXTURE



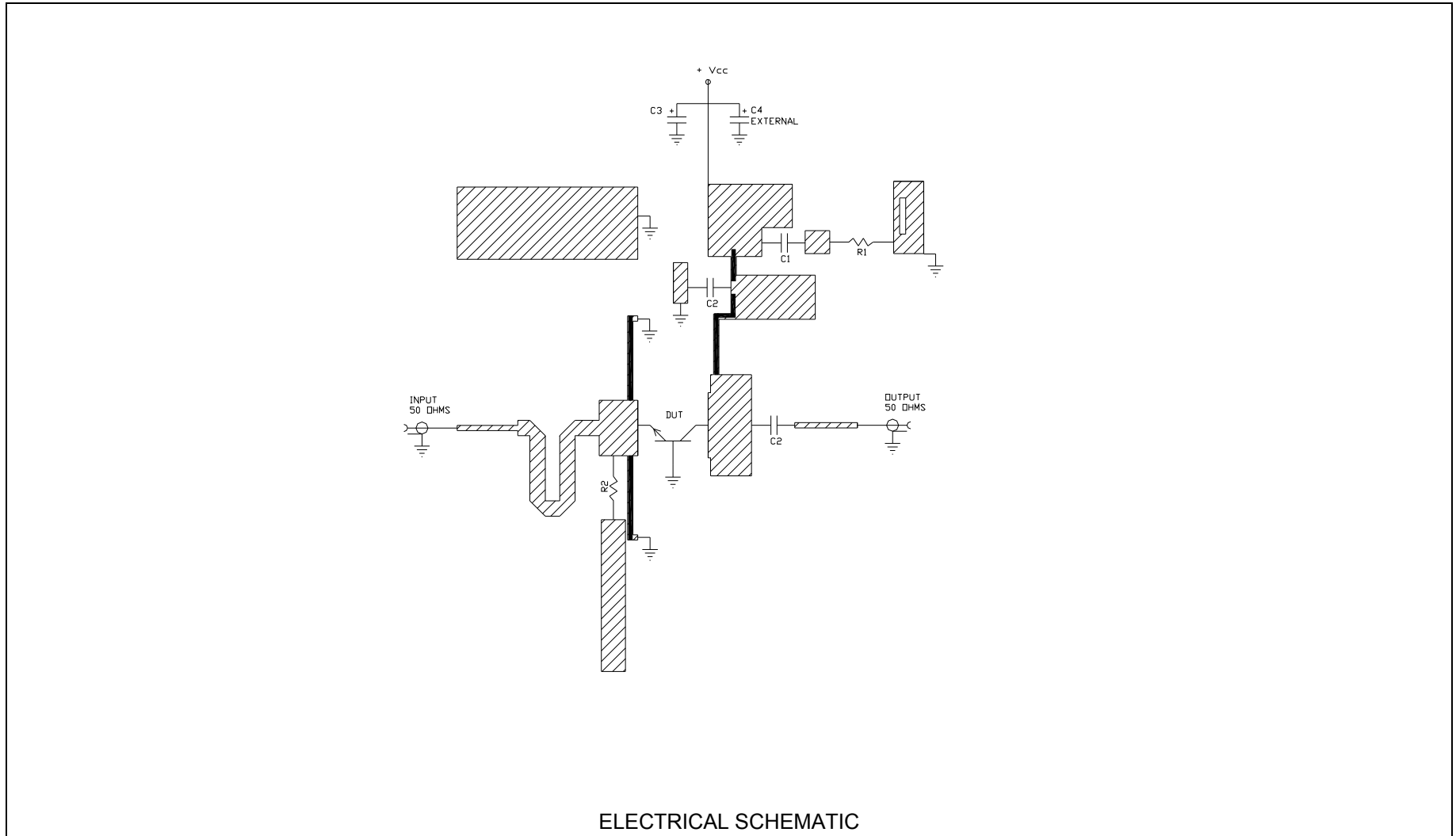
COMPONENT	DESCRIPTION
DUT	TRANSISTOR #IB2931MH155 MOUNT HARD TO THE RIGHT
PC BOARD	ROGERS #R0 6010.2LM 2E/2E .025"
C1	SNUB CAPACITOR 0.1uF
C2	CHIP CAPACITOR ATC100A 39pF
C3	ELECTROLYTIC CAPACITOR 98uF/6.3V
C4 (NOT SHOWN)	ELECTROLYTIC CAPACITOR 4700uF / 50V
R1	SNUB RESISTOR 6.81 Ohms
R2	CHIP RESISTOR 51 Ohms
BIAS (3 PLACES)	BIAS LINE WIRE
GS (5 PLACES)	GROUND SHIM, COPPER, TH=0.001"
CONN 1, CONN 2	SMA CONNECTOR, QS #2052-5636-02
INPUT PC BOARD CARRIER	2 INCH BRASS-02 (0.75")
OUTPUT PC BOARD CARRIER	2 INCH BRASS-01 (0.5")
TRANSISTOR CARRIER	2 INCH COPPER-02 (P44)
TRANSISTOR CLAMP	NDRYL CLAMP-02 (P44)
ALUMINUM HEAT SINK	2 INCH HEATSINK-09
DC CONN 1	BANANA JACK, BLACK
DC CONN 2	BANANA JACK, RED
NOTE	FIXTURE HARDWARE DRAWINGS AVAILABLE ON REQUEST

ASSEMBLY AND PARTS LIST

RF TEST FIXTURE



RF TEST FIXTURE



DEFINITIONS

Data Sheet Status	
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.
Maximum Ratings	
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

Product and environmental safety - toxic materials
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.

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