

## S-Band Radar Transistor

The high power pulsed radar transistor device part number IB2731MH65 is designed for S-Band radar systems operating over the instantaneous bandwidth of 2.7-3.1 GHz. While operating in class C mode this common base device supplies a minimum of 65 watts of peak pulse power under the conditions of 100 $\mu$ s pulse width and 15% 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 (%)	V <sub>CC</sub> (V)	P <sub>IN</sub> (W)	IRL (dB)	P <sub>OUT</sub> (W)	G <sub>p</sub> (dB)	OPC (dB)	OPF (dB)	I <sub>c</sub> (A)	n <sub>c</sub> (%)	IP (deg)	Droop (dB)	VSWR 1.5:1	VSWR 2:1
OPC	2.700	100	15	36.0	9.5	--	87	--	0.29	--	--	--	--	--	--	--
Nominal	2.700	100	15	36.0	8.5	-12	82	9.8	--	0.82	3.98	57	462	-0.140	S	P
OPC	2.900	100	15	36.0	9.5	--	83	--	0.34	--	--	--	--	--	--	--
Nominal	2.900	100	15	36.0	8.5	-24	77	9.6	--	--	3.95	54	317	-0.200	S	P
OPC	3.100	100	15	36.0	9.5	--	71	--	0.20	--	--	--	--	--	--	--
Nominal	3.100	100	15	36.0	8.5	-23	68	9.0	--	--	3.75	50	531	-0.230	S	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	$R_{TH(JC)}$	--	0.44	°C/W	$V_{CC}=V1, PW=PW1, DF=DF1, T_F=25\pm5^\circ C, P_{OUT}=65W, Nc\geq 40\%$ .
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	$I_C = 30mA, V_{BE} = 0V, T_F = 25\pm5^\circ C$ .
100%	Zero Base Voltage Collector Leakage Current	$I_{CES}$	--	6	mA	$V_{CE} = 36V, V_{BE} = 0V, T_F = 25\pm5^\circ C$ .
100%	DC Current Gain	$H_{FE}$	10	150	--	$V_{CE} = 5V, I_C = 100mA, T_F = 25\pm5^\circ C$ .

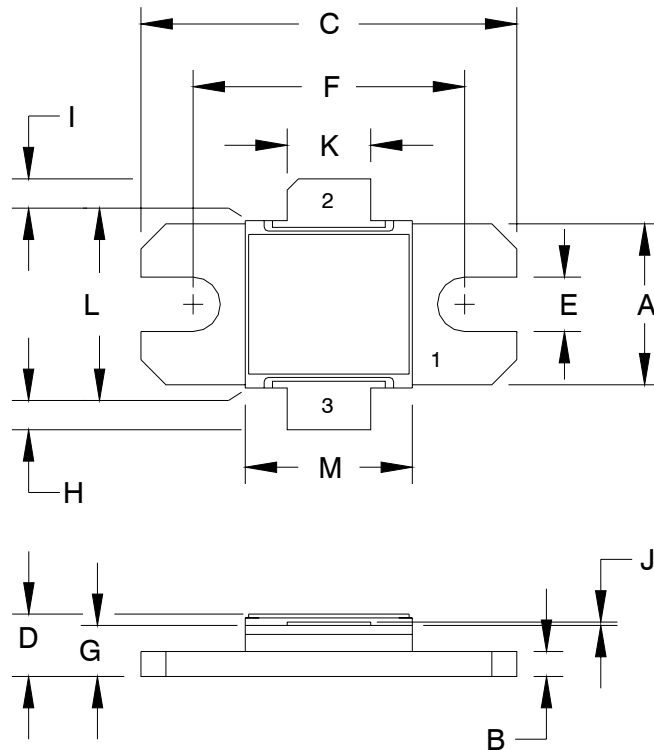
**RF ELECTRICAL CHARACTERISTICS**

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
100%	Input Return Loss	IRL	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	$P_O$	65	--	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 ( $P_O/I_C/V_{CC}$ )	$N_C$	40	--	%	$V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN1}, P_{IN2}, P_{IN3}, F=F1, F2, F3.$
100%	Pulse Amplitude Droop	D	--	0.7	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 Flatness = $10 \cdot \text{LOG}(P_{O\text{MAX}}/P_{O\text{MIN}})$	OPF	--	1	dB	Calculate from $P_O$ at each frequency F.
100%	Output Power Compression = $10 \cdot \text{LOG}(P_{OC}/P_O)$	OPC	-0.02	+0.52	dB	$P_{OC}$ measured with $P_{IN}$ increased by 0.5dB at F=F1, F2, F3.
100%	Delta Insertion Phase Variation	d-IP	-30	+30	Deg	$V_{CC}=V1, PW=PW1, DF=DF1, T_F= T_{F1}, P_{IN}=P_{IN2}, F=F3$ , Mark in 5° increments. Measure at $T=PW1 \div 2$ time position.
100%	Stability into 1.5:1 VSWR	VSWR-S	--	--	--	Repeat $P_O$ with $P_{IN} = P_{IN1}, P_{IN2}, P_{IN3}$ . 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 -65 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 $P_O = \text{Pre test } P_O \pm 0.2\text{dB}$ .
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	$V1 = 36V \pm 1V; PW1 = 100\mu s; DF1 = 15\%; P_{IN1} = P_{IN2} = P_{IN3} = 8.5W; F1 = 2.70 \text{ GHz}, F2 = 2.90 \text{ GHz}, F3 = 3.10 \text{ GHz}, T_{F1} = 25 \pm 5^\circ\text{C}.$					
Note	$T_F = \text{Device flange temperature.}$					
Note	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					
Note	Screen 'BD' = parameter qualified By Design.					

**RF TEST FIXTURE IMPEDANCE CHARACTERISTICS**

Frequency (MHz)	$Z_{IF} (\Omega)$	$Z_{OF} (\Omega)$
2.7	7.22 -j7.91	6.79 -j7.66
2.8	6.97 -j7.32	6.27 -j7.65
2.9	6.85 -j6.87	5.77 -j7.65
3.0	6.81 -j6.51	5.28 -j7.66
3.1	6.81 -j6.18	4.78 -j7.60
Impedance Definition		

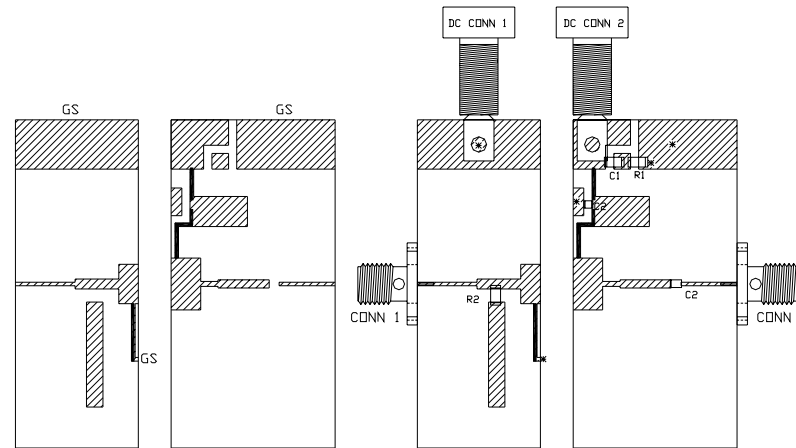
**PACKAGE DIMENSIONAL OUTLINE DRAWING**



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	0.050	0.105	1.65	1.91
I	0.050	0.105	2.41	2.67
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**

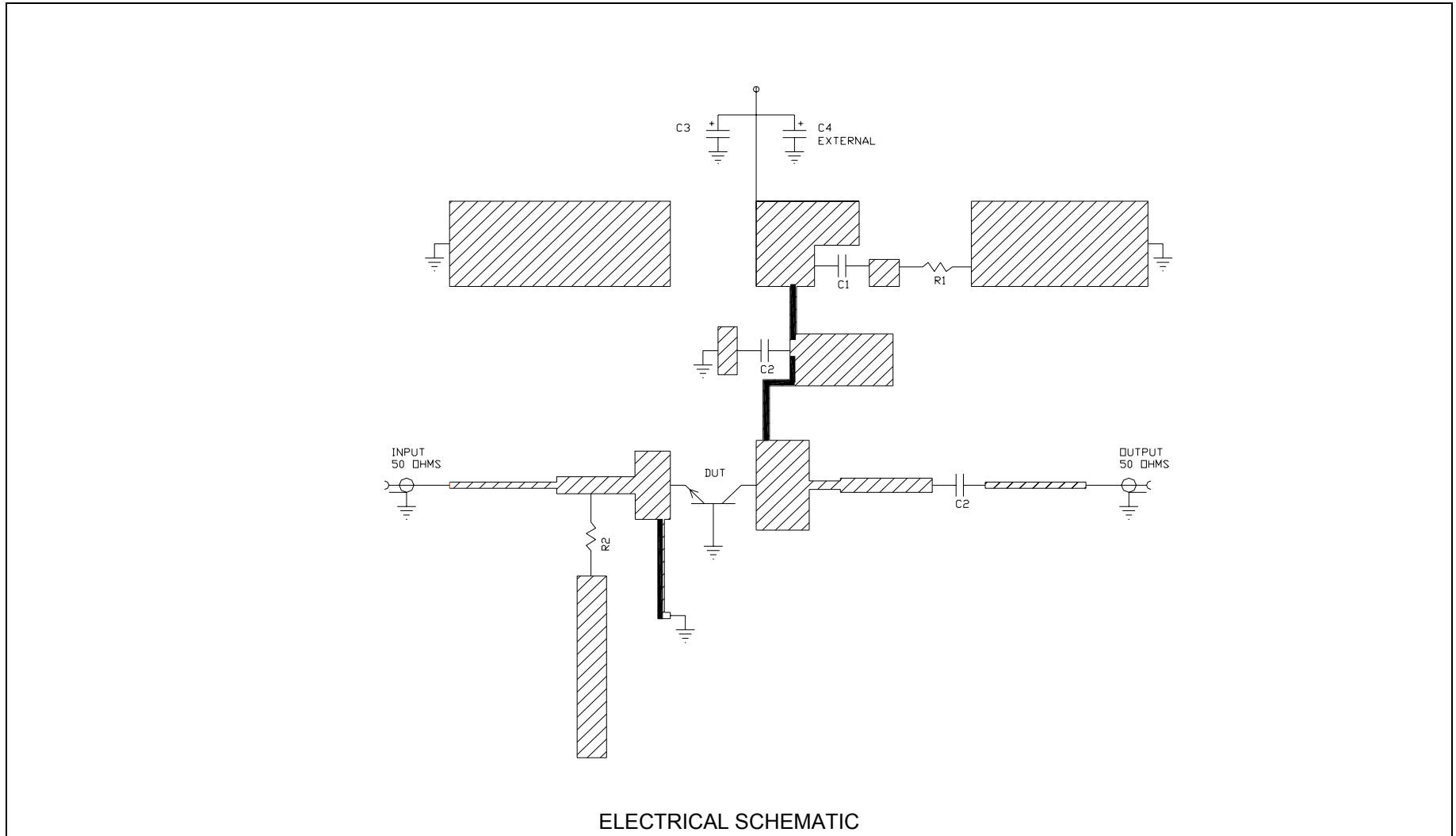


COMPONENT	DESCRIPTION
DUT	TRANSISTOR #IB2731MH65, MOUNT HARD TO THE RIGHT
PC BOARD	ROGERS #RT6010 0.2LM 2E/2E .025"
C1	SNUB CAPACITOR 0.1uF
C2	ATC100A 39pF
C3	ELECTROLYTIC CAPACITOR, 68uF / 63V
C4 (NOT SHOWN)	ELECTROLYTIC CAPACITOR, 4700uF / 50V
R1	SNUB RESISTOR 6.81 OHMS
R2	CHIP RESISTOR 200 OHMS
GS (5 PLACES)	GROUND SHIM, COPPER, TH=0.001"
CONN 1, CONN 2	SMA CONNECTOR, GS #2052-5636-02
INPUT PC BOARD CARRIER	2 INCH BRASS-02 (0.75")
OUTPUT PC BOARD CARRIER	2 INCH BRASS-03 (1")
TRANSISTOR CARRIER	2 INCH COPPER-02
TRANSISTOR CLAMP	NORYL CLAMP-03
ALUMINUM HEAT SINK	2 INCH HEATSINK-03
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**



**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.

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