Part Number: IB2931MH155

Integra
TECHNOLOGIES, INC.

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

Patents Issued
- US 6181200 B1
- US 6331931 B1

TYPICAL DATA TYPICAL DATA TYPICAL DATA TYPICAL DATA

	Freq (GHz)	P_{IN} (W)	IRL (dB)	P_{OUT} (W)	G_P (dB)	OPC (dB)	OPF (dB)	I_C (A)	n_C (%)	Droop (dB)	Droop (P-F)	VSWR-S 1.5:1	LMT 2:1
OPC	2.900	26.9	--	183	--	0.12	--	--	--	--	--	--	--
Nominal	2.900	24.0	-14	178	8.7	--	0.20	12.12	41	-0.50	P	--	P
1.5:1 Stability / OD	2.900	28.2	--	--	--	--	--	--	--	--	--	S	--
OPC	3.000	26.9	--	187	--	0.20	--	--	--	--	--	--	--
Nominal	3.000	24.0	-14	179	8.7	--	--	11.70	42	-0.45	P	--	P
1.5:1 Stability / OD	3.000	28.2	--	--	--	--	--	--	--	--	--	S	--
OPC	3.100	26.9	--	177	--	0.15	--	--	--	--	--	--	--
Nominal	3.100	24.0	-16	171	8.5	--	--	10.85	44	-0.29	P	--	P
1.5:1 Stability / OD	3.100	28.2	--	--	--	--	--	--	--	--	--	S	--

PW=100us, Duty=10%, Vcc=36V

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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±5°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±5°C.
100%	Zero Base Voltage Collector Leakage Current	I_{CES}	--	6.0	mA	V_{CE}=30V, V_{BE}=0V, T_F=25±5°C.
100%	DC Current Gain	H_{FE}	10	120	--	V_{CE}=5V, I_C=0.1A, T_F=25±5°C.

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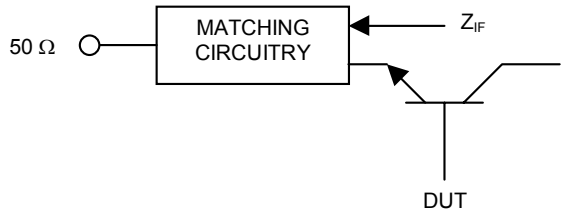
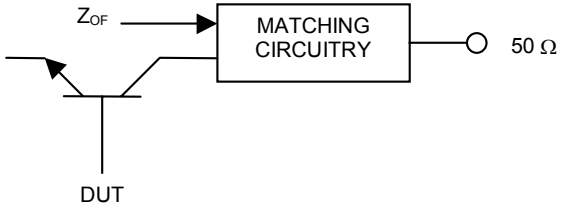
RF ELECTRICAL CHARACTERISTICS

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
100%	Input Return Loss	IRL	--	-7	dB	V_{CC}=V1, PW=PW1, DF=DF1, T_F=25±5°C, P_{IN}=P_{IN1}, F=F1, F2, F3
100%	Output Power	P_{OUT}	155	--	W	V_{CC}=V1, PW=PW1, DF=DF1, T_F=25±5°C, P_{IN}=P_{IN1}, F=F1, F2, F3
100%	Collector Efficiency ($P_O/I_C/V_{CC}$)	N_C	38	--	%	V_{CC}=V1, PW=PW1, DF=DF1, T_F=25±5°C, P_{IN}=P_{IN1}, F=F1, F2, F3
100%	Pulse Amplitude Droop	D	--	0.70	dB	V_{CC}=V1, PW=PW1, DF=DF1, T_F=25±5°C, P_{IN}=P_{IN1}, F=F1, F2, F3
100%	Output Power Compression =10*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*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±5°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±5°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±5°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 = Pre test P_O±5W.
BD	Risetime	RT	--	150	ns	V_{CC}=V1, PW=PW1, DF=DF1, T_F=25±5°C, P_{IN}=P_{IN1}, F=F1, F2, F3 Measure at 10 & 90% detected power points.
Note 1	V1 = 36V; PW1 = 100µs; DF1 = 10%; P_{IN1} = P_{IN2} = P_{IN3} = 16.3 W; F1 = 2.90 GHz, F2 = 3.00 GHz, F3 = 3.10 GHz.					
Note 2	T_F = 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} (Ω)	Z_{OF} (Ω)
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		

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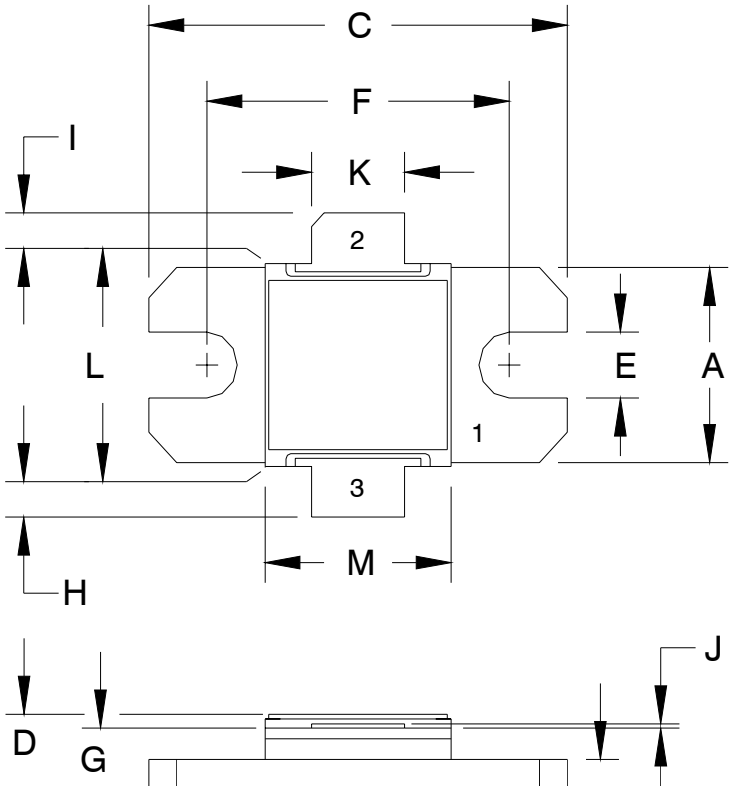

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.380	0.390	9.65	9.91
B	0.058	0.062	1.47	1.57
C	0.895	0.905	22.73	22.99
D	0.157	0.177	3.99	4.50
E	0.125	0.135	3.18	3.43
F	0.645	0.655	16.38	16.64
G	0.112	0.132	2.84	3.35
H	0.107	0.147	2.7	3.73
I	0.107	0.147	2.7	3.73
J	0.003	0.005	0.08	0.13
K	0.195	0.205	4.95	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

PACKAGE DIMENSIONAL OUTLINE DRAWING

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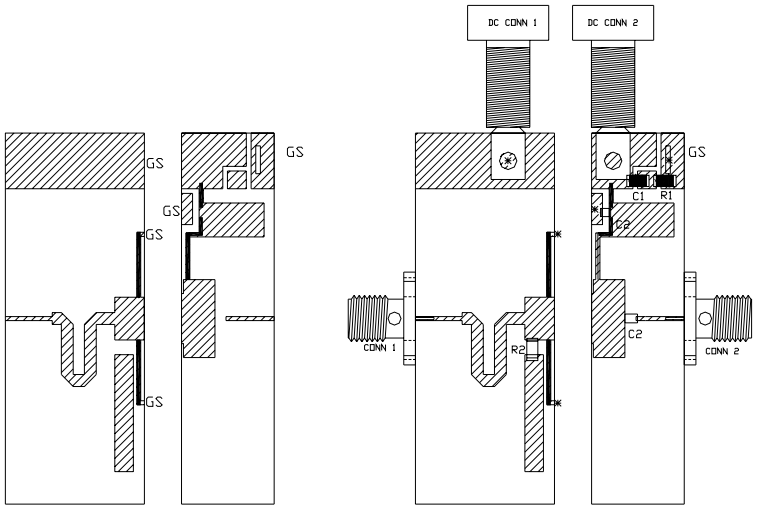
RF TEST FIXTURE



COMPONENT	DESCRIPTION
DUT	TRANSISTOR #IB2931MH155 MOUNT HARD TO THE RIGHT
PC BOARD	ROGERS #RO 6010.2LM 2E/2E .025"
C1	SNUB CAPACITOR 0.1uF
C2	CHIP CAPACITOR ATC100A 39pF
C3	ELECTROLYTIC CAPACITOR 98uF/63V
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, OS #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	NORYL 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

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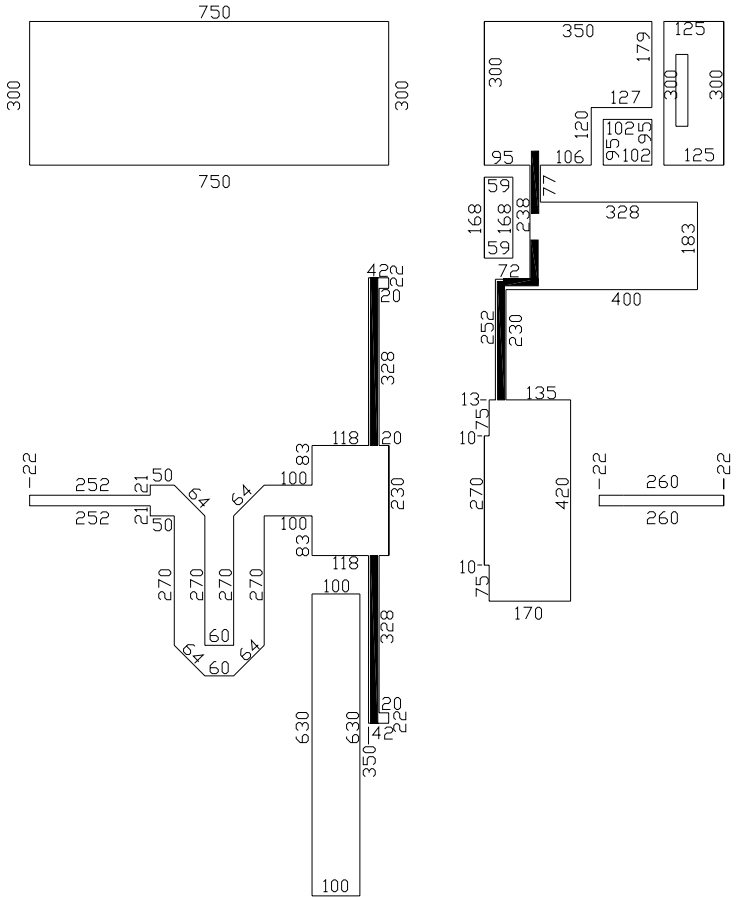

CIRCUIT DIMENSIONS

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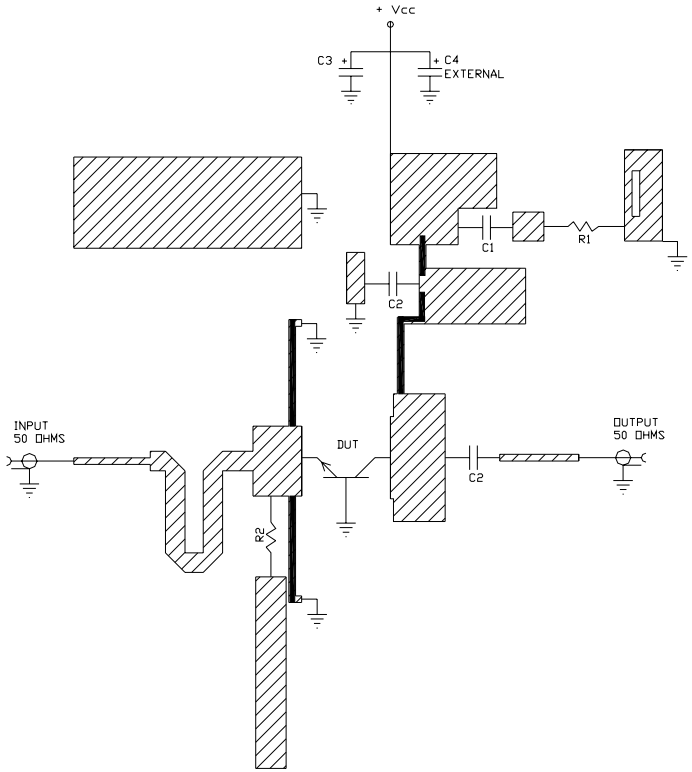

ELECTRICAL SCHEMATIC

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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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