

# Part Number: IB2729M150



TECHNOLOGIES, INC.

## S-Band Radar Transistor

The high power pulsed radar transistor part number IB2729M150 is designed for S-Band ATC radar systems operating over the instantaneous bandwidth of 2.7-2.9 GHz. While operating in class C mode this common base device supplies a minimum of 150 watts of peak pulse power under the conditions of 100µs 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. The test fixture includes a passive amplitude sloping network to insure that the device is not overdriven as the operating frequency decreases. Located on the input impedance matching structure, this network allows an input drive characteristic that is flat with frequency.



- 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
- BeO Package
  - Unmatched Thermal Reliability
- RF Test Fixture
  - Broadband
  - Matched to 50Ω
  - Long-term Correlation
  - 100% Device RF Screening
  - No External Tuning Allowed
- Insertion Phase Marking
  - 5° Increment Marking
- US Patent Number
  - 6181200B1
  - 6331931B1

*TYPICAL DATA      TYPICAL DATA      TYPICAL DATA      TYPICAL DATA*

Test 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)	OPC (dB)	OPF (dB)	I <sub>C</sub> (A)	η <sub>C</sub> (%)	Droop (dB)	VSWR 1.5:1	VSWR 2:1
OPC	2.700	100	10	36.0	24.0	--	189	--	0.14	--	--	--	--	--	--
Nominal	2.700	100	10	36.0	21.4	-13	183	9.3	--	0.11	10.40	49	-0.10	--	Pass
1.5:1 VSWR/OD	2.700	100	10	36.0	25.1	--	--	--	--	--	--	--	--	Stable	--
OPC	2.800	100	10	36.0	24.0	--	193	--	0.20	--	--	--	--	--	--
Nominal	2.800	100	10	36.0	21.4	-23	185	9.4	--	--	10.58	48	-0.30	--	Pass
1.5:1 VSWR/OD	2.800	100	10	36.0	25.1	--	--	--	--	--	--	--	--	Stable	--
OPC	2.900	100	10	36.0	24.0	--	191	--	0.27	--	--	--	--	--	--
Nominal	2.900	100	10	36.0	21.4	-23	180	9.2	--	--	10.26	49	-0.30	--	Pass
1.5:1 VSWR/OD	2.900	100	10	36.0	25.1	--	--	--	--	--	--	--	--	Stable	--

**MAXIMUM RATINGS**

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
BD	Collector-Emitter Voltage	$V_{CES}$	--	70	V	$V_{BE}=0V$ .
BD	Emitter-Base Voltage	$V_{EBO}$	--	3.5	V	--
BD	Collector Current, Peak	$I_C$	--	15.5	A	$PW=100\mu s$ , $DF=10\%$ .
BD	Continuous Power Dissipation, Peak	$P_D$	--	475	W	$PW=100\mu s$ , $DF=10\%$ , $T_F=25^\circ C$ .
BD	Storage Temperature Range	$T_{STG}$	-55	+150	$^\circ C$	--
BD	Operating Junction Temperature Range	$T_J$	-55	+200	$^\circ C$	--
Note	Screen 'BD' = parameter qualified By Design.					

**THERMAL CHARACTERISTICS**

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
BD	Thermal Resistance	$R_{TH(JC)}$	--	0.30	$^\circ C/W$	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{OUT}=160W$ , $N_C=40\%$ , $P_{IN}=21W$ .
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 K.
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.					

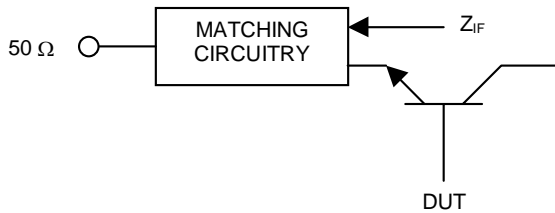
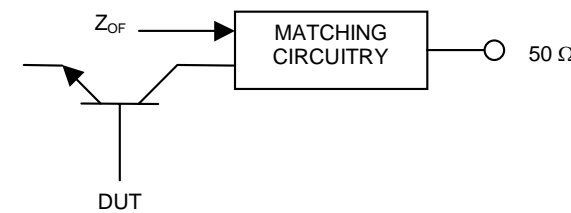
**DC ELECTRICAL CHARACTERISTICS**

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
100%	Collector-Emitter Breakdown Voltage	$BV_{CES}$	70	--	V	$I_C=40mA$ , $V_{BE}=0V$ , $T_F=25\pm 5^\circ C$ .
100%	Zero Base Voltage Collector Leakage Current	$I_{CES}$	--	7.5	mA	$V_{CE}=40V$ , $V_{BE}=0V$ , $T_F=25\pm 5^\circ C$ .
100%	DC Current Gain	$H_{FE}$	10	100	--	$V_{CE}=5V$ , $I_C=0.1A$ , $T_F=25\pm 5^\circ C$ .

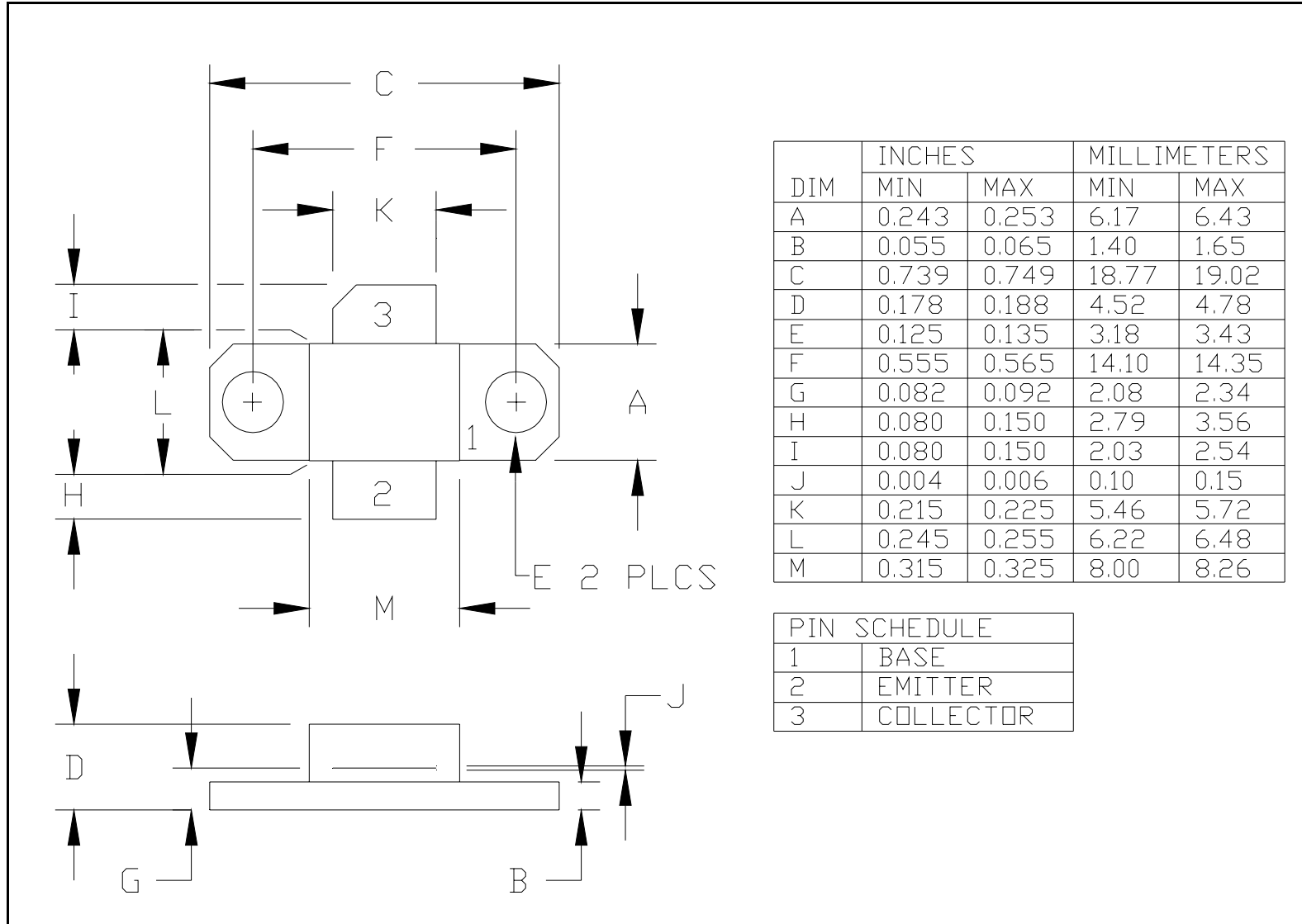
## RF ELECTRICAL CHARACTERISTICS

Screen	Parameter	Symbol	Min	Max	Units	Test Conditions
100%	Input Return Loss	IRL	7	--	dB	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ .
100%	Output Power	$P_O$	150	--	W	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ .
100%	Collector Efficiency ( $P_O/I_C/V_{CC}$ )	$N_C$	40	--	%	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ .
100%	Pulse Amplitude Droop	D	--	0.6	dB	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ .
100%	Output Power Flatness = $10 \cdot \text{LOG}(P_{O\text{MAX}}/P_{O\text{MIN}})$	OPF	--	0.75	dB	Calculate from $P_O$ at each frequency F.
100%	Output Power Compression = $10 \cdot \text{LOG}(P_{OC}/P_O)$	OPC	+0.05	+0.45	dB	$P_{OC}$ measured with $P_{IN}$ increased by 0.5dB at $F=F1$ , $F2$ , $F3$ .
100%	Insertion Phase	IP	-30	+30	Deg	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN2}$ , $F=F2$ , Mark in $5^\circ$ increments.
100%	Stability into 1.5:1 VSWR with +0.7dB overdrive	VSWR-S	--	--	--	Repeat $P_O$ with $P_{IN}$ increased by 0.7dB. Rotate 1.5:1 output VSWR through $360^\circ$ 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	--	--	--	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ . Rotate 2:1 output VSWR through $360^\circ$ phase. Post test $P_O = \text{Pre test } P_O \pm 10W$ .
BD	Pulse Risetime	RT	--	150	ns	$V_{CC}=36V$ , $PW=100\mu s$ , $DF=10\%$ , $T_F=25\pm 5^\circ C$ , $P_{IN}=P_{IN1}$ , $P_{IN2}$ , $P_{IN3}$ , $F=F1$ , $F2$ , $F3$ . Measure between 10% and 90% detected power points.
Note	F1 = 2.70 GHz, F2 = 2.80 GHz, F3 = 2.90 GHz.					
Note	$P_{IN1} = 21.4W$ , $P_{IN2} = 21.4W$ , $P_{IN3} = 21.4W$ .					
Note	$T_F$ = Device flange temperature.					
Note	Parts are binned and marked in 5 degree increments for Insertion Phase IP.					
Note	Screen 'BD' = parameter qualified By Design.					

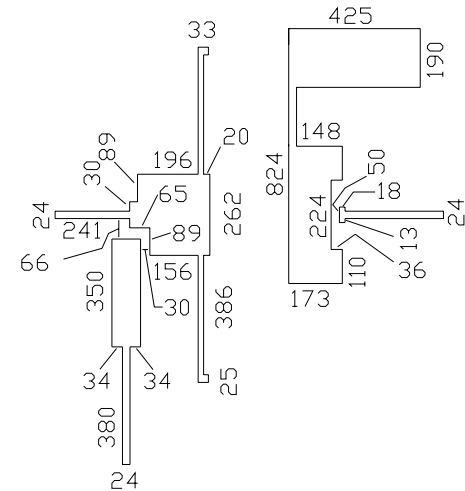
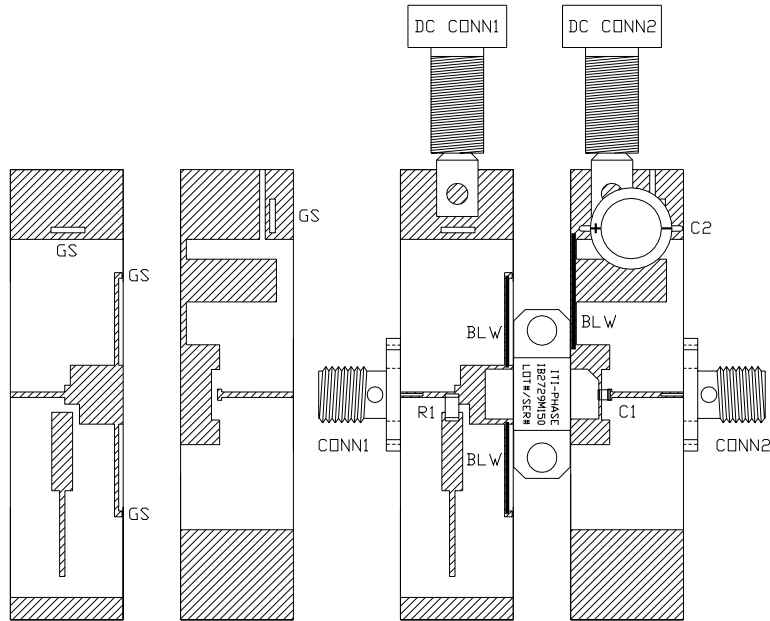
## BROADBAND RF TEST FIXTURE IMPEDANCE CHARACTERISTICS

Frequency (GHz)	$Z_{IF}$ ( $\Omega$ )	$Z_{OF}$ ( $\Omega$ )
2.70	3.3 - j6.1	1.8 - j5.1
2.80	2.8 - j6.0	1.4 - j4.9
2.90	2.3 - j5.3	1.1 - j4.3
Impedance Definition		

**PACKAGE DIMENSIONAL OUTLINE DRAWING**



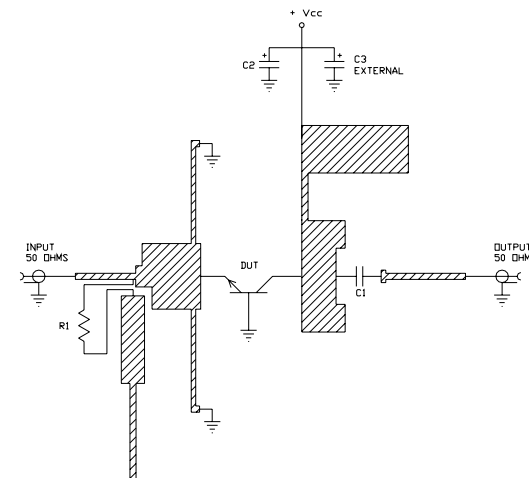
**BROADBAND RF TEST FIXTURE**



**CIRCUIT DIMENSIONS IN MILS (1 MIL = 0.001")**

COMPONENT	DESCRIPTION
DUT	TRANSISTOR #IB2729M150, MOUNT HARD TO THE RIGHT
PC BOARD	ROGERS #R03010, TH=0.025"
C1	CHIP CAPACITOR, TYPE ATC100A, 39 pF
C2	ELECTROLYTIC CAPACITOR, 68uF / 63V
C3	ELECTROLYTIC CAPACITOR, 4700uF / 50V
GS	GROUND SHIM, COPPER, TH=0.001"
CONN1, CONN2	SMA CONNECTOR, TYPE DS #2052-5636-02
INPUT PC BOARD CARRIER	2 INCH BRASS - 01
OUTPUT PC BOARD CARRIER	2 INCH BRASS - 01
TRANSISTOR CARRIER	2 INCH COPPER - 01
TRANSISTOR CLAMP	NDRYL CLAMP -01
HEATSINK	2 INCH HEATSINK - 09
DC CONN1	BANANA JACK, BLACK
DC CONN2	BANANA JACK, RED
BLW	BIAS LINE WIRE - COPPER - 0.022" DIA TYPICAL
R1	24 OHM CHIP RESISTOR
NOTE	FIXTURE HARDWARE DRAWINGS AVAILABLE ON REQUEST

**ASSEMBLY AND PARTS LIST**



**ELECTRICAL SCHEMATIC**

**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 and 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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