Avantek, Inc.

1985

Semiconductor Device Catalog

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Avantek, Inc. recommends that before the products described herein are written into specifications or used in critical applications that the performance characteristics be verified by contacting Avantek Transistors Sales.

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MODAMP™
IMFET™

Some **Avantek** products are manufactured under the following U.S. patents: 3809817, 3931472, 3978282, Re. 29844

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1) Input offset voltage is 1.6 v.

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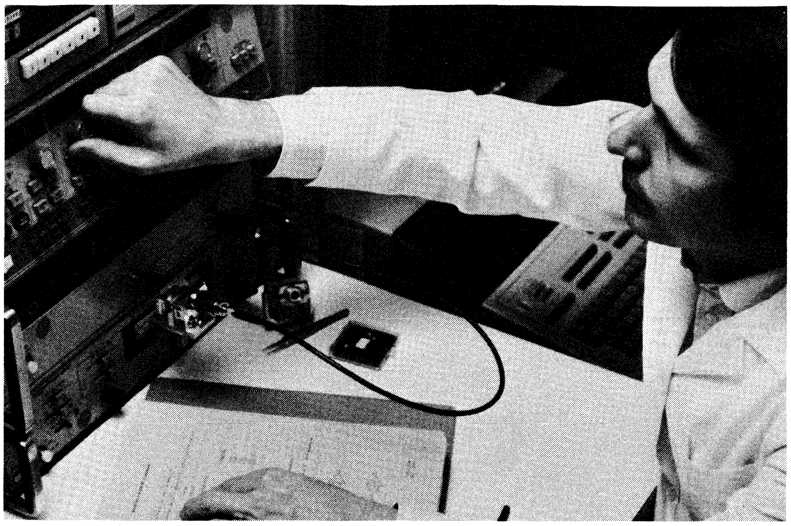
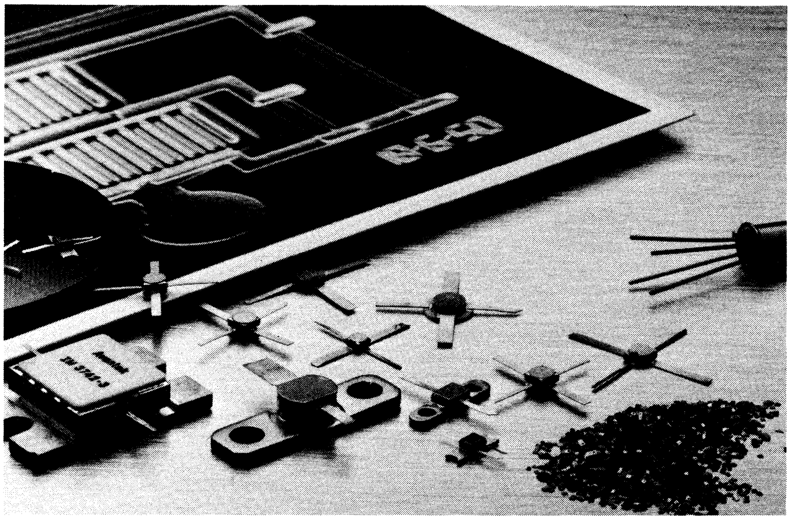
Introduction

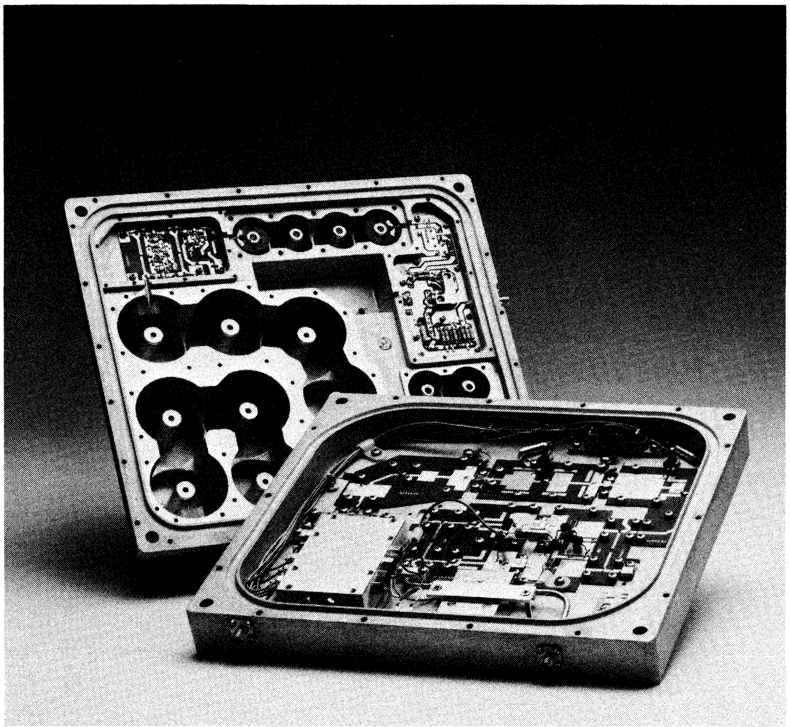
*A*vantek: No single product tells the entire story.

Avantek specializes in the development and production of microwave transistors, solid state microwave components, multi-function assemblies and telecommunications equipment. The company was founded in late 1965 to meet the electronics industry's need for high performance solid-state VHF, UHF and microwave amplifiers. By December of 1965, the company had developed a family of low-noise solid-state preamplifiers covering the 30 to 1000 MHz frequency range. Less than six months later Avantek added solid-state microwave amplifiers with octave band frequency coverage through 2300 MHz as well as narrowband amplifiers for specific communications bands in that frequency range. This early family of highly reliable transistor amplifiers played a significant part in the microwave industry's trend toward the replacement of tube type amplifiers with solid-state amplifiers.



Avantek was the first company in the microwave components field to recognize and exploit the advantages of vertical integration. This strategy has allowed us to introduce, year after year, an ever-expanding line of new products with critical components produced internally. Since 1968, Avantek has developed and manufactured its own microwave transistors. The capability to design and produce its own high-performance microwave transistors in-house is one of the important factors leading to Avantek's present success. Virtually every microwave transistor used in an Avantek product is an Avantek transistor. This strategic posture allows new product innovation to benefit from the close association of circuit designers and the semiconductor design process.





Today, Avantek's vertical integration begins with basic research into new materials and techniques for the production of gallium arsenide (GaAs) and silicon transistors and monolithic integrated circuits. It ends with the design, installation and support of complete telecommunication systems. This vertical integration exists thoughout the company–in every division and in every product category.

For the markets that Avantek serves, vertical integration assures technological leadership. Avantek offers the microwave industry's broadest product line, consisting of over 500 standard proprietary products operating at frequencies from DC to 40 GHz. Worldwide, Avantek now serves nearly 5000 customers in the markets of defense, earth station and satellite communications, cable television, microwave measurement and terrestrial communications. In each market, Avantek is the leader in technology, product quality and customer support.

For Avantek's customers, this vertical integration assures not only the advantages of superior performance, but also higher product quality and reliability, since it permits control of the most critical parts from raw materials to final inspection. Thus, Avantek's vertical integration provides the customer with more reliable delivery and superior performance throughout all product lines.

Semiconductor Division

Avantek's semiconductor division offers an ever-increasing line of microwave transistors and microwave monolithic integrated circuits. Special attention is paid to the industry's need for ultra low noise, wide dynamic range microwave transistors and for power devices that are designed for specific bands and minimum circuit tuning.

Avantek has one of the most modern silicon bipolar technologies in the world. The packaged silicon planar epitaxial bipolar transistors combine high gain with low noise figures and wide dynamic range for applications ranging up to approximately 6 GHz for amplifier use and up to 12 GHz for oscillator applications. New processing and self-alignment techniques have given our bipolar products superior and repeatable performance. This microwave semiconductor technology has made possible Avantek's development of silicon monolithic microwave integrated circuit (MMIC) amplifiers which are presently in production and operating at frequencies through 4 GHz. Avantek has developed silicon and gallium arsenide MMIC amplifiers that are being incorporated throughout the company's vertically integrated product lines.

The semiconductor division is the largest U.S. supplier of gallium arsenide field effect transistors (GaAs FETs) including low noise, high gain and high power versions that operate from a few MHz to approximately 4 GHz. A new series of internally matched field effect transistors (IMFETs™) featuring high-power output with very low VSWR, meet the electronic industry's need for communications band power transistors.

All Avantek semiconductor products are fabricated under stringent, environmentally controlled conditions using proprietary process equipment. Advanced production techniques are evident in areas such as epitaxial layer growth, precision optical photolithography, electron beam disposition, ion implantation, high-vacuum RF sputtering, plasma etching and ion milling. Advanced process control produces transistors with 0.25 micron critical feature dimensions and with extremely predictable electrical performance. Each Avantek transistor features gold metallization. This unique combination of manufacturing methods results in premium quality semiconductor devices with built-in performance and reliability.

Avantek Employees and Facilities

Today, there are over 2500 employees in the Avantek family supported by some of the industry's most modern equipment and facilities in the 233,000 sq. ft. headquarters complex in Santa Clara, the 185,000 sq. ft. Telecommunications Division building in Milpitas and a temporary facility in Folsom, CA. Avantek has a 90,000 sq. ft. facility under construction in Folsom that will be in operation before the end of 1984 and a 90,000 sq. ft. semiconductor fabrication facility under construction in Newark, CA which is scheduled for completion in August of 1985. This staff and floorspace supports Avantek's vertical integration: to manufacture high-performance transistors and monolithic circuits, to build them into amplifiers and other functional "blocks," to integrate these components into supercomponents, to provide complete, ready-to-operate "turnkey" telecommunications systems-and to support its products with research, engineering, quality control and total customer support.

Some Information About This Catalog

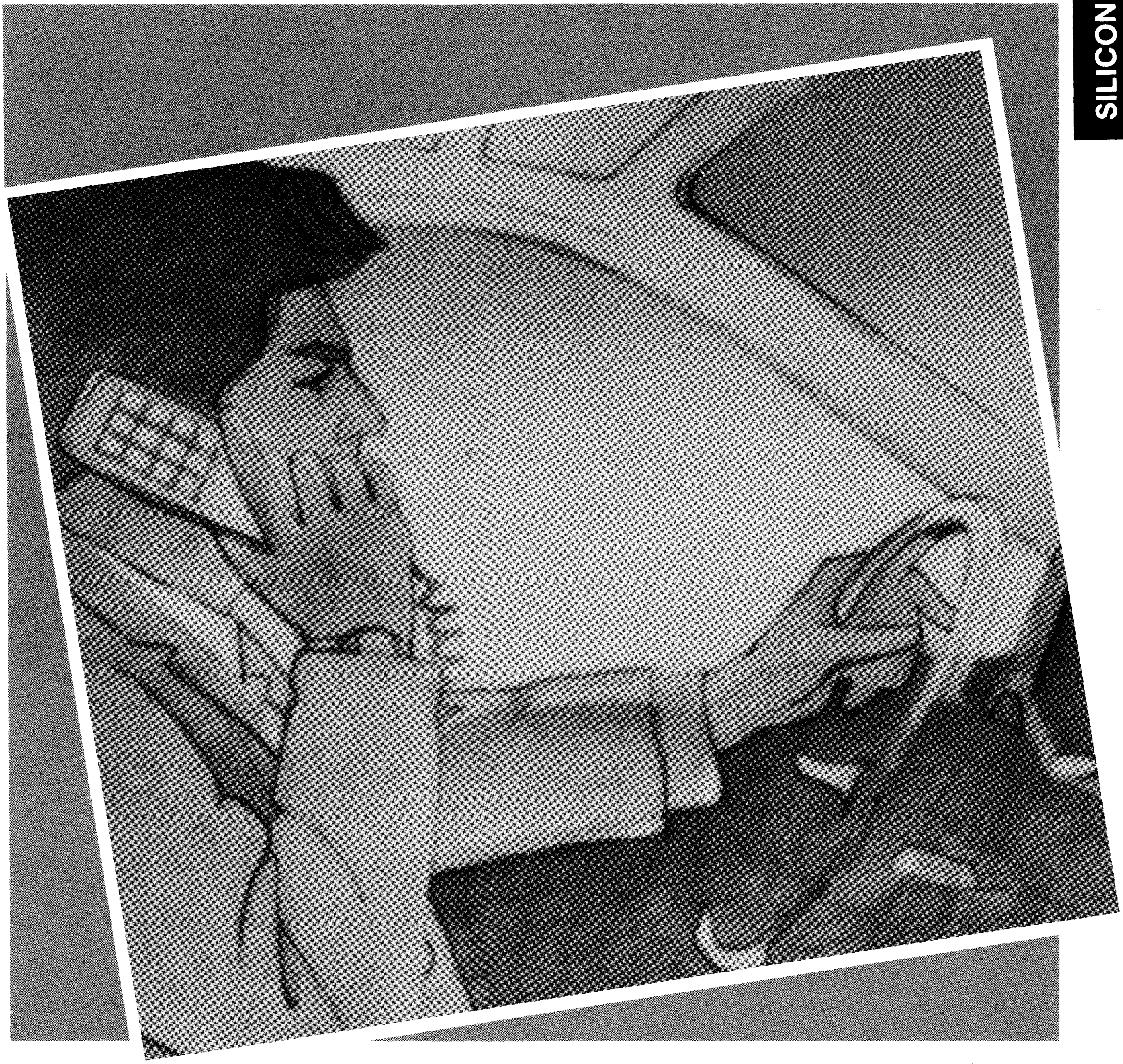
The 1984 edition of Avantek's Semiconductor Catalog contains detailed information on our full line of standard RF and microwave semiconductor products. The catalog is divided into five product sections: Silicon Bipolar Transistors, Silicon Monolithic Integrated Circuits, Gallium Arsenide Field Effect Transistors (GaAs FETs), Internally Matched Power Field Effect Transistors (IMFETs™). A brief description is provided at the beginning of each product listing.

The catalog also contains: Selection Guides, an Alphanumeric product index, chip number/part number/package number cross reference guide, an abstract of application notes and a product case outline section.

At the end of the Semiconductor products sections are additional sections covering Avantek's other product lines, including: microwave components-amplifiers, switches, mixers, oscillators, limiters, attenuators and detectors; and Telecommunication products-solid state microwave components, subsystems, satellite television and microwave receivers, low-noise preamplifiers, antenna- and rack-mounted downconverters, signal power dividers, digital radio systems, and test instruments for CATV systems.

A description of Avantek's High Reliability Transistor Screening is included to provide an overview of our exacting criteria for our HiRel products.

Microwave Silicon Bipolar Transistors



INTRODUCTION — SILICON BIPOLAR TRANSISTORS

Avantek offers an ever-increasing line of VHF, UHF and microwave silicon bipolar transistors that combine high gain, low noise figures and moderate power output for applications up to 6 GHz (oscillator applications up to 12 GHz). Special attention is paid to the industry's need for wide dynamic range VHF-UHF transistors and for moderate power devices.

All Avantek silicon bipolar transistors use nitride self-alignment and ion-implantation for precise control of emitter and base doping. The transistor die are metalized with one micrometer thick gold and passivated with silicon nitride.

All Avantek transistors are 100% tested for RF and DC performance before shipment. For applications requiring a further assurance of reliability, Avantek offers JANTXV and JANS equivalent screening as well as customer specified screening.

Common-base and common-collector variations for oscillator applications are available on request.

Guaranteed Performance: LOW NOISE SILICON BIPOLAR TRANSISTORS

Part Number	Maximum Useable Frequency (GHz)	Test Frequency (GHz)	NF_O (dB) Typ	G_A (dB) Typ	S_{21} @ 1 GHz (dB)	f_{max} (GHz)	Package
AT-60572	1	0.5	1.2	12	14.5	7	TO-72
AT-60535	5	2	1.6	12	18.5	14	micro-X
AT-60510	5	2	1.6	12	18.5	14	100 mil
AT-60570	5	2	1.6	12	19	15	70 mil
AT-41472	1	0.5	1.2	14	14	8	TO-72
AT-41435-3	6	2	1.6	14	18	15	micro-X
AT-41410	6	2	1.6	14	18	15	100 mil
AT-41470	6	2	1.6	14.5	18.5	16	70 mil

Guaranteed Performance: GENERAL PURPOSE Si BIPOLAR TRANSISTORS

Part Number	Maximum Useable Frequency (GHz)	Test Frequency (GHz)	NF_O (dB) Typ	G_A (dB) Typ	S_{21} @ 1 GHz (dB)	f_{max} (GHz)	Package
AT-41435-5	6	2	2.0	14	18	15	micro-X
AT-42035	5	2	2.5	13	17	14	micro-X
AT-42010	5	2	2.5	13	17	14	100 mil
AT-42070	5	2	2.5	13.5	17.5	15	70 mil
AT-00572	1	0.5	2.5	15	10.5	4	TO-72
AT-00535	3	1	3.0	13	14.5	8	micro-X
AT-00510	3	1	3.0	13	14.5	8	100 mil
AT-00570	3	1	3.0	13.5	15	9	70 mil
AT-01672	1	0.5	2.5	14.5	8	3	TO-72
AT-01635	3	1	3.0	12.5	12	8	micro-X
AT-01610	3	1	3.0	12.5	12	8	100 mil
AT-01670	3	1	3.0	13	12.5	9	70 mil

Guaranteed Performance: LINEAR POWER Si BIPOLAR TRANSISTORS

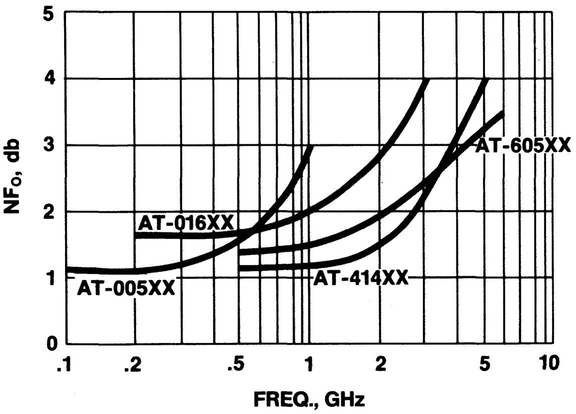
Part Number	Maximum Useable Frequency (GHz)	Test Frequency (GHz)	P_{1dB} (dBm) Typ	G_{1dB} (dB) Typ	S_{21} @ 1 GHz (dB)	f_{max} (GHz)	Package
AT-64020	4	2	29	10	12.5	8	200 mil BeO
AT-64023	5	4	27	9	12.5	8	Flange BeO

RECOMMENDED Si BIPOLAR TRANSISTORS FOR CLASS-A AMPLIFIER APPLICATIONS

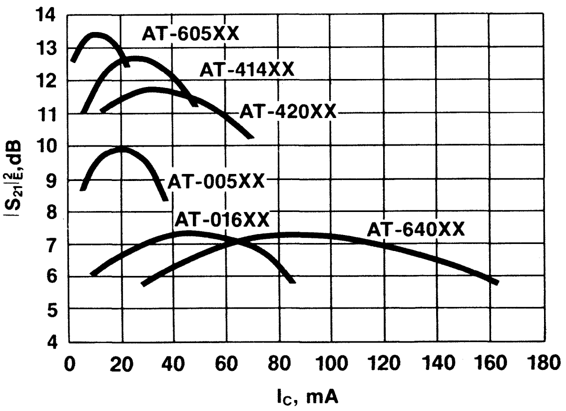
Frequency	Low Noise Amplifier Stages	Intermediate Amplifier Stages	Driver/Output Amplifier Stages
100 MHz	AT-00572	AT-00572 AT-01672	AT-01672
500 MHz	AT-41470 AT-00572 AT-60570 AT-41435-3	AT-00572 AT-01635 AT-41435-5 AT-42070	AT-01672 AT-01635 AT-64020
1 GHz	AT-01670 AT-60570 AT-41435-3 AT-41470	AT-41435-5 AT-41410 AT-42070	AT-64020 AT-01610 AT-01635 AT-42035 AT-42070
2 GHz	AT-60570 AT-41435-3 AT-41470	AT-41435-5 AT-41410 AT-42035 AT-42070	AT-64023 AT-64020 AT-01610 AT-01635 AT-42035
4 GHz	AT-60570 AT-41435-3 AT-41470	AT-41435-5 AT-42035 AT-42070	AT-64023 AT-42035 AT-42070

TYPICAL PERFORMANCE: Si BIPOLAR TRANSISTORS

TYPICAL OPTIMUM NOISE FIGURE (NF$_o$) vs FREQUENCY



TYPICAL INSERTION POWER GAIN ($|S_{21}|^2_E$) vs. COLLECTOR CURRENT FREQUENCY = 2GHz



AT-00510
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

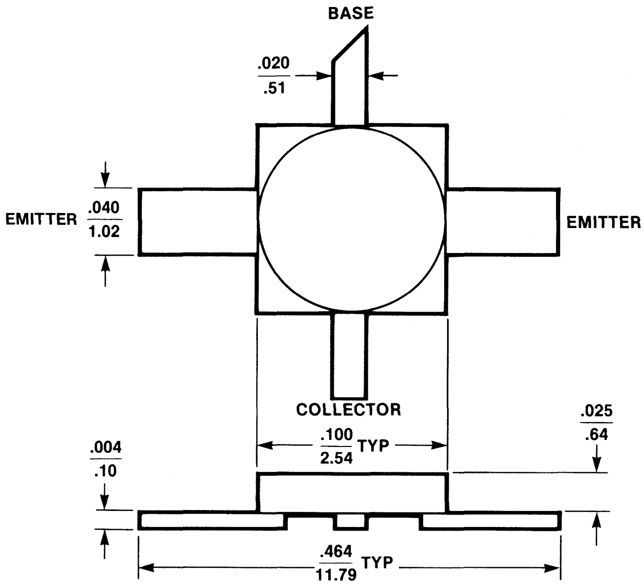
- **Moderate Current Operation**
- **12.5 dB MAG @ 2 GHz**
- **20 dB $|S_{21}|^2$ @ 500 GHz**
- **3 dB NF_O @ 2 GHz**
- **High Rel Package**

DESCRIPTION

The AT-00510 is a silicon bipolar transistor designed to operate at moderate currents for maximum dynamic range. This high gain device uses nitride self-alignment and ion implantation for precise control of emitter and base doping.

This transistor is fabricated in the high performance 100 mil stripline package; a hermetically sealed, high reliability ceramic package having gold-plated leads.

Avantek 100 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=15 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 13.0 	20.0 15.0 9.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=15 mA	2.0 GHz	dB		12.5	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		16.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 25 mA		dB		10.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 5 mA	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 15 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			1.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		0.5	

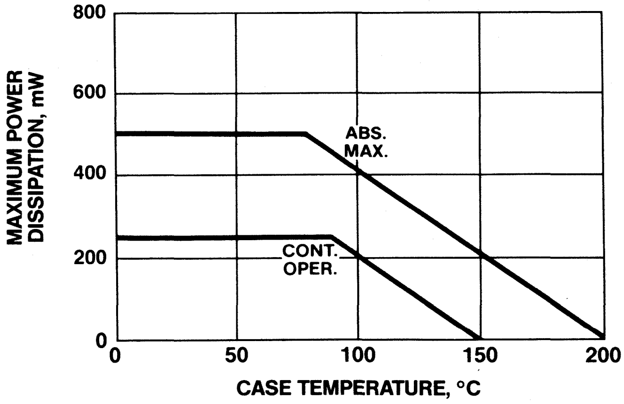
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	25 mA	50 mA
Continuous Dissipation[3]	P_T	250 mW	500 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	– 65°C to 150°C	200°C

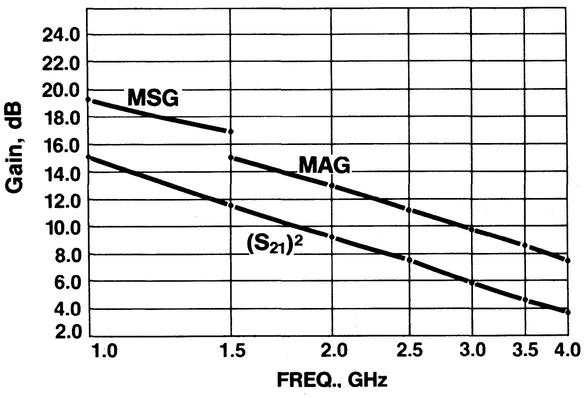
Thermal Resistance, θ_{jc}: 200°C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25°C.

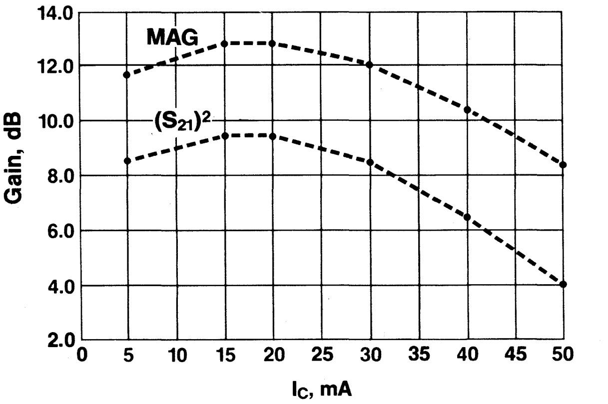
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 15 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 2.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 15 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.581	-146.5	20.78	96.9	.045	39.2	.385	-62.8
1.0	.566	-178.3	15.20	73.2	.061	28.7	.261	-72.0
1.5	.564	163.0	11.70	55.4	.080	36.1	.228	-82.8
2.0	.579	148.3	9.41	39.5	.097	33.7	.218	-95.3
2.5	.598	133.9	7.58	26.4	.112	24.7	.225	-106.9
3.0	.605	122.9	6.11	11.5	.128	20.1	.250	-123.6
3.5	.615	112.0	4.80	-.5	.144	13.8	.277	-136.5
4.0	.636	101.6	3.84	-14.1	.157	6.6	.301	-151.8

AT-00535
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

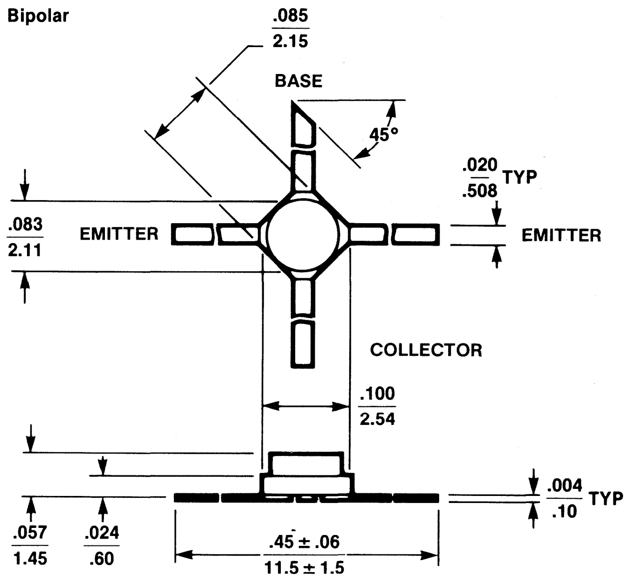
FEATURES

- **Moderate Current Operation**
- **12.5 dB MAG @ 2 GHz**
- **20 dB $|S_{21}|^2$ @ 500 GHz**
- **3 dB NF_O @ 2 GHz**
- **Low Cost Package**

DESCRIPTION

The AT-00535 is a silicon bipolar transistor designed to operate at moderate currents for maximum dynamic range. This high gain device uses nitride self-alignment and ion implantation for precise control of emitter and base doping. This transistor is fabricated in the high performance, low priced micro-X package, a hermetically sealed, ceramic package having tin-plated leads.

Avantek micro-X Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=15 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 13.0 	20.0 15.0 9.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=15 mA	2.0 GHz	dB		12.5	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		16.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 25 mA		dB		10.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 5 mA	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 15 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			1.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		0.5	

RECOMMENDED MAXIMUM RATINGS

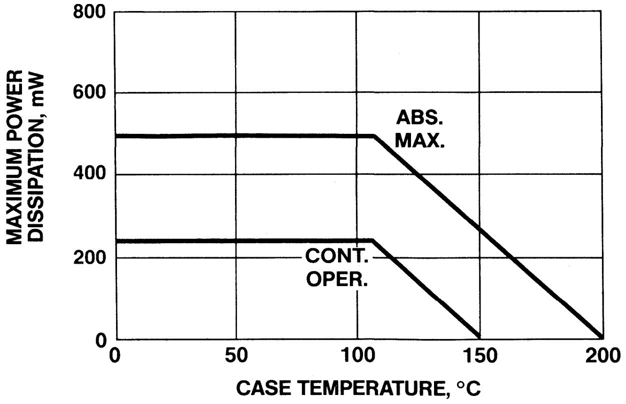
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current[3]	I_C	25 mA	50 mA
Continuous Dissipation[3]	P_T	250 mW	500 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature[4]	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 200°C/W

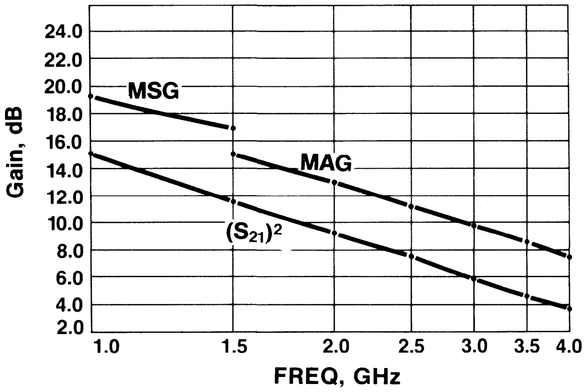
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. $T_{CASE}=25$°C.
4. Storage above + 150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200°C.

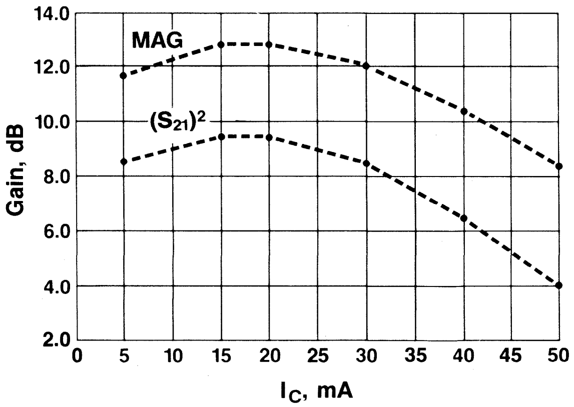
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 15 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 2.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 15 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.515	-139.5	20.75	98.1	.050	43.1	.410	-60.7
1.0	.489	-176.2	15.22	73.6	.071	40.9	.267	-70.2
1.5	.492	161.5	11.75	55.7	.094	37.1	.219	-80.2
2.0	.516	144.3	9.45	39.7	.116	32.2	.196	-92.7
2.5	.541	129.6	7.66	25.8	.136	23.3	.178	-111.5
3.0	.566	117.2	6.09	11.1	.154	16.7	.183	-129.7
3.5	.589	105.3	4.77	-.4	.171	9.4	.191	-145.3
4.0	.623	95.0	3.75	-14.1	.185	1.1	.207	-164.4

AT-00570
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

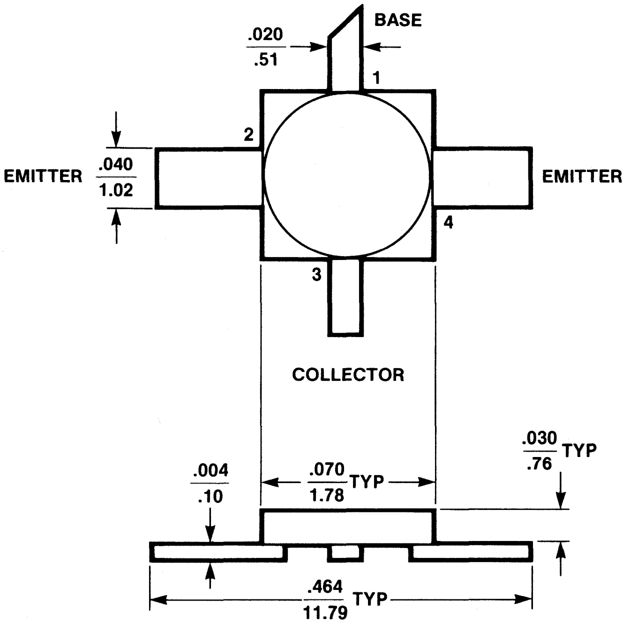
- **Moderate Current Operation**
- **13.5 dB MAG @ 2 GHz**
- **21 dB $|S_{21}|^2$ @ 500 GHz**
- **3 dB NF_O @ 2 GHz**
- **High Rel Package**

DESCRIPTION

The AT-00570 is a silicon bipolar transistor designed to operate at moderate currents for maximum dynamic range. This high gain device uses nitride self-alignment and ion implantation for precise control of emitter and base doping.

This transistor is fabricated in the high performance 70 mil stripline package; a hermetically sealed, high reliability ceramic package having gold-plated leads.

Avantek 70 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=15 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 14.0 	21.0 15.5 9.5	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=15 mA	2.0 GHz	dB		13.5	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		16.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 25 mA		dB		11.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 5 mA	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 15 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			1.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		0.5	

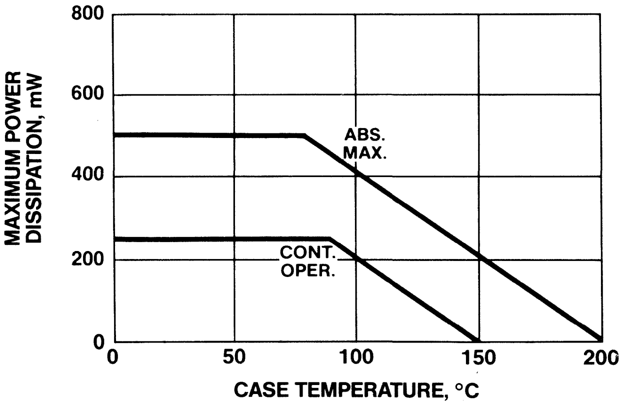
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	25 mA	50 mA
Continuous Dissipation[3]	P_T	250 mW	500 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature	T_{STG}	— 65° C to 150° C	200° C

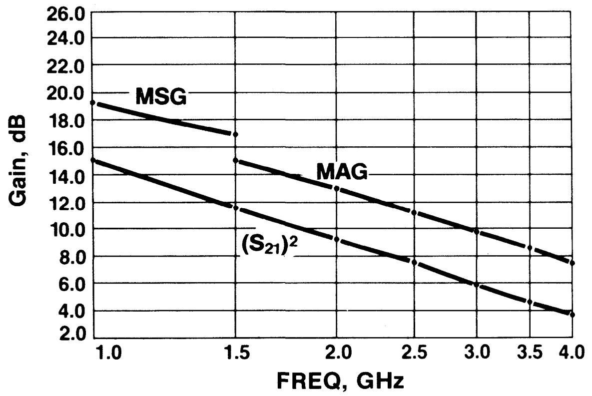
Thermal Resistance, θ_{jc}: 200° C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

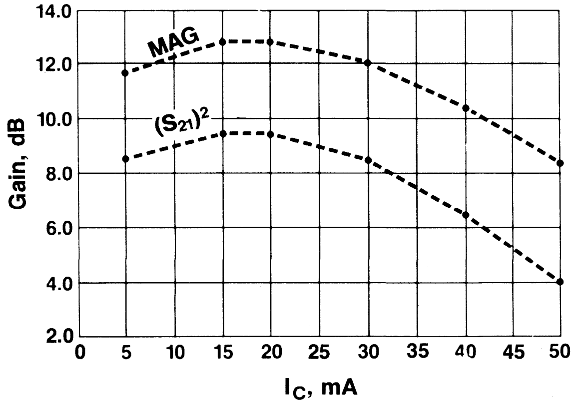
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 15 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 2.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 2 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.622	-148.1	21.33	97.4	.041	34.8	.411	-62.0
1.0	.612	-179.2	15.72	73.2	.053	32.5	.287	-72.8
1.5	.609	162.2	12.16	55.4	.067	29.5	.256	-84.0
2.0	.623	148.2	9.82	39.4	.080	27.9	.245	-97.6
2.5	.635	134.6	7.90	26.8	.091	18.0	.262	-108.8
3.0	.644	124.3	6.24	11.8	.103	12.8	.289	-124.7
3.5	.653	114.0	4.80	.1	.115	6.1	.317	-136.3
4.0	.670	105.1	3.74	-13.4	.124	-1.4	.341	-150.8

AT-00572
.06-1 GHz General Purpose Silicon Bipolar Transistor Summary Data

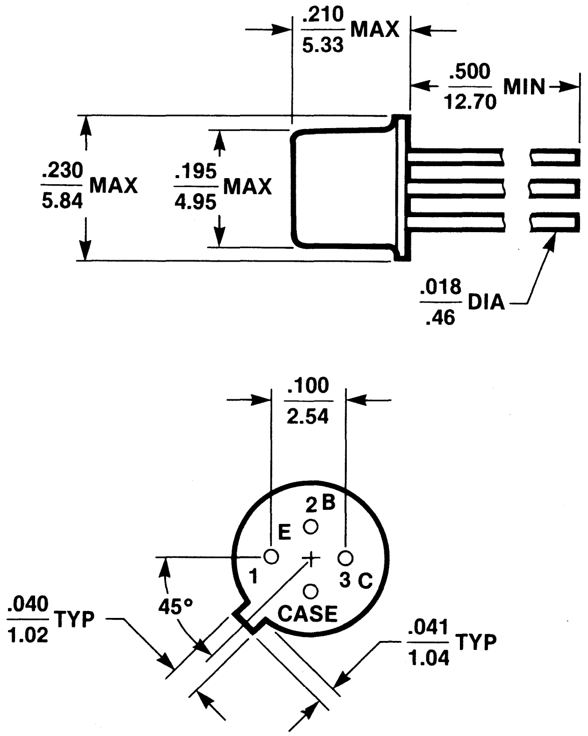
FEATURES

- **Moderate Current Operation**
- **18 dB MAG @ 500 GHz**
- **15 dB $|S_{21}|^2$ @ 500 GHz**
- **1.9 dB NF_O @ 500 GHz**
- **High Rel Package**

DESCRIPTION

The AT-00572 is a silicon bipolar transistor designed to operate at moderate currents for maximum dynamic range. This high gain device uses nitride self-alignment and ion implantation for precise control of emitter and base doping. This transistor is fabricated in the TO-72 package, a hermetically sealed, high reliability, industry standard metal package.

Avantek TO-72 Package



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=15 mA	0.1 GHz 0.5 GHz 1.0 GHz	dB	14	25 15 10	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=15 mA	0.5 GHz 1.0 GHz	dB		18 12	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression, V_{CE} = 8.0V, I_C = 25 mA	1.0 GHz	dBm		18	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 3 mA	0.5 GHz	dB		1.9	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 15 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			1.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		0.8	

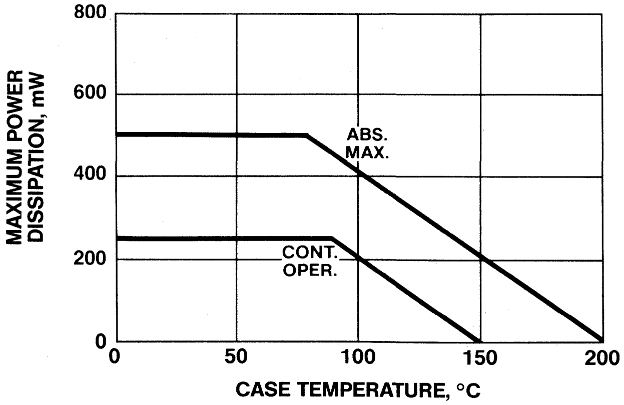
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	25 mA	50 mA
Continuous Dissipation[3]	P_T	250 mW	500 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature	T_{STG}	– 65° C to 150° C	200° C

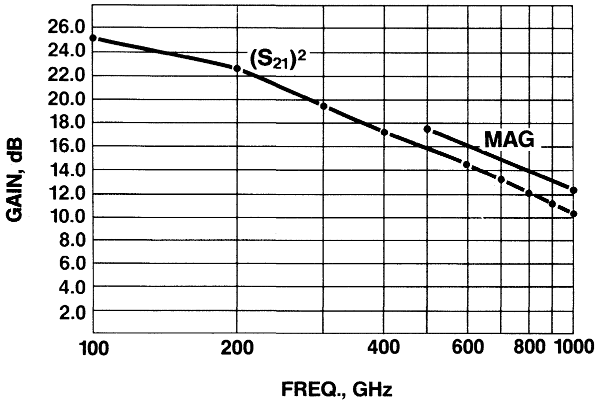
Thermal Resistance, θ_{jc}: 200° C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

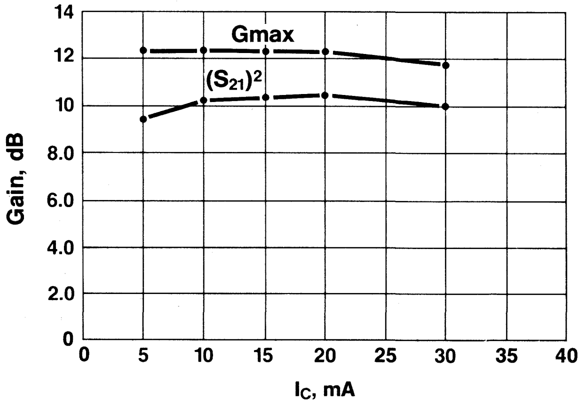
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 15 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 1.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 15 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	dB	Ang	Mag	Ang
0.1	.572	-35.4	25.349	134.5	-32.560	77.9	.787	-20.5
0.2	.384	-52.7	22.401	114.5	-27.705	74.3	.630	-26.1
0.3	.293	-58.5	19.440	103.5	-24.936	74.0	.555	-25.9
0.4	.225	-62.7	17.375	96.0	-22.950	72.9	.501	-25.8
0.5	.184	-66.8	15.569	89.6	-21.273	72.2	.463	-27.3
0.6	.162	-69.9	14.161	85.8	-19.988	72.5	.446	-31.2
0.7	.145	-70.7	13.160	81.7	-18.721	71.6	.438	-35.1
0.8	.133	-71.0	12.094	76.7	-17.439	70.0	.449	-38.6
0.9	.116	-72.2	11.313	72.0	-16.637	68.4	.459	-41.3
1.0	.098	-76.6	10.320	67.5	-15.930	67.6	.461	-43.4

AT-01610
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

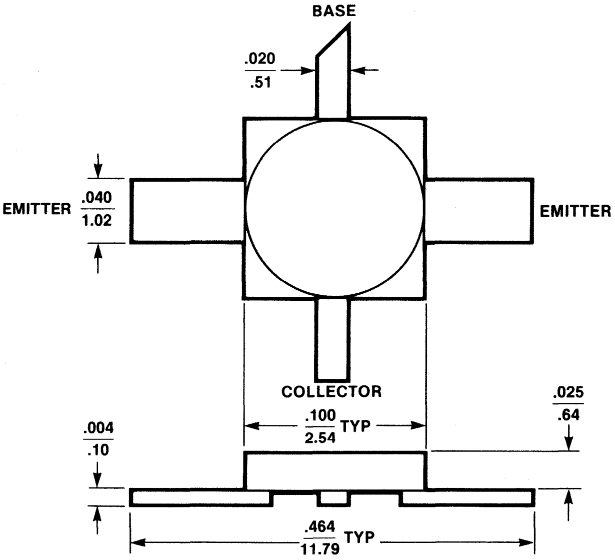
- **Wide Dynamic Range**
- **12 dB $|S_{21}|^2$ @ 1 GHz**
- **22 dBm $P_{1\,dB}$ @ 2 GHz**
- **1 Watt Maximum P_T**
- **High Rel Package**

DESCRIPTION

The AT-01610 is a high gain, medium power silicon bipolar transistor designed for use as an intermediate power linear amplifier at frequencies through 4 GHz. It is fabricated in the high performance 100 mil stripline package; a hermetically sealed high reliability ceramic package having gold plated leads.

This transistor uses nitride self alignment and ion implantation for precise control of emitter and base doping.

Avantek 100 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$

2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=35 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 11.0 	18.0 12.0 6.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=35 mA	1.0 GHz 2.0 GHz	dB		17.0 11.0	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		22.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 60 mA		dB		9.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 10 mA	1.0 GHz	dB		2.5	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 35 mA			30	100	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		1.0	

RECOMMENDED MAXIMUM RATINGS

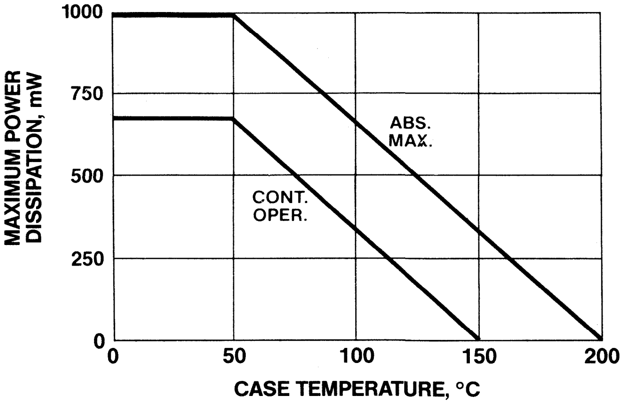
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	90 mA	150 mA
Continuous Dissipation[3]	P_T	600 mW	1000 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 150°C/W

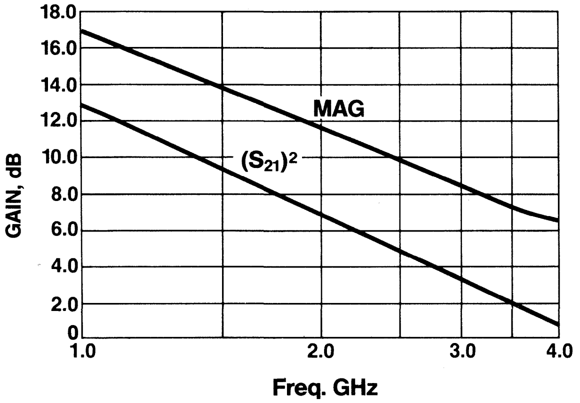
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

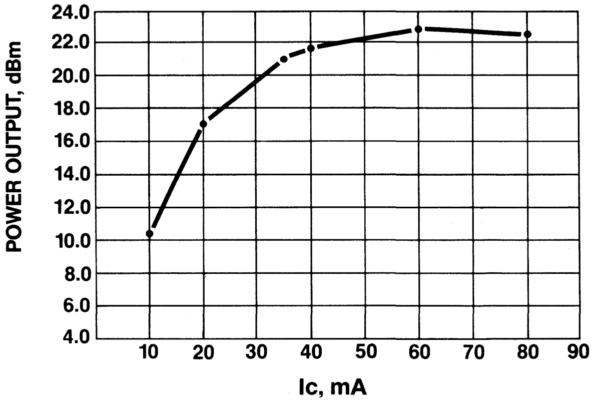
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
V_{CE} = 8V, I_C = 35 mA



POWER OUTPUT @ 1 dB GAIN COMPRESSION vs. COLLECTOR CURRENT
V_{CB} = 8V, FREQUENCY = 2 GHz



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8.0V, I_C = 35 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.76	-178.7	18.57	85.4	.033	42.4	.26	-146.8
1.0	.76	164.1	12.72	67.1	.051	48.3	.25	-167.2
1.5	.77	153.3	9.39	53.2	.072	46.8	.25	-179.5
2.0	.79	143.0	6.85	39.6	.084	38.2	.27	176.6
2.5	.79	132.0	5.20	26.3	.102	35.8	.29	169.6
3.0	.79	122.8	3.56	12.9	.121	27.9	.30	165.6
3.5	.80	113.0	2.38	1.7	.136	24.1	.32	160.8
4.0	.80	103.4	1.28	-9.4	.151	16.3	.35	156.0

AT-01635
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

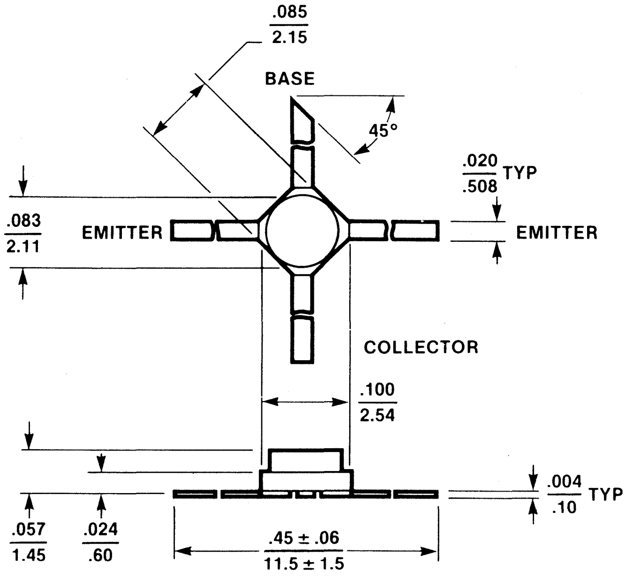
- **Wide Dynamic Range**
- **12 dB $|S_{21}|^2$ @ 1 GHz**
- **22 dBm $P_{1\,dB}$ @ 2 GHz**
- **1 Watt Maximum P_T**
- **High Rel Package**

DESCRIPTION

The AT-01635 is a high gain, medium power silicon bipolar transistor designed for use as an intermediate power linear amplifier at frequencies through 4 GHz. It is fabricated in the economical micro-X package; a hermetically sealed ceramic package having tin-plated leads.

This transistor uses nitride self alignment and ion implantation for precise control of emitter and base doping.

Avantek micro-X Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=35 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 11.0	18.0 12.0 6.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=35 mA	1.0 GHz 2.0 GHz	dB		16.5 11.0	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		22.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 60 mA		dB		9.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 10 mA	1.0 GHz	dB		2.5	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 35 mA			30	100	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		1.0	

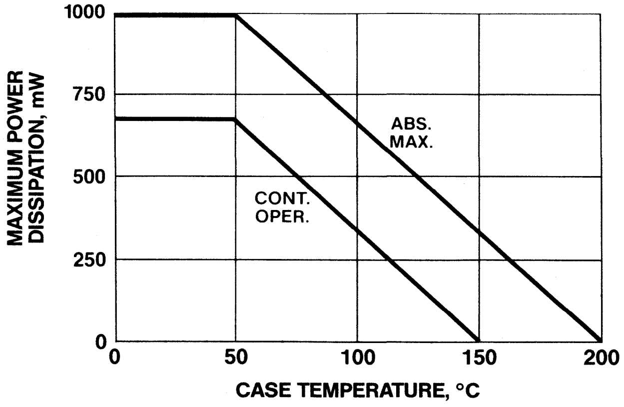
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	90 mA	150 mA
Continuous Dissipation[3]	P_T	600 mW	1000 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature[4]	T_{STG}	– 65° C to 150° C	200° C

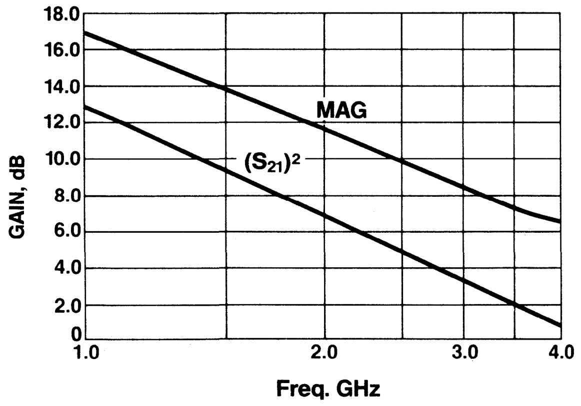
Thermal Resistance, θ_{jc}: 150° C/W

Notes:

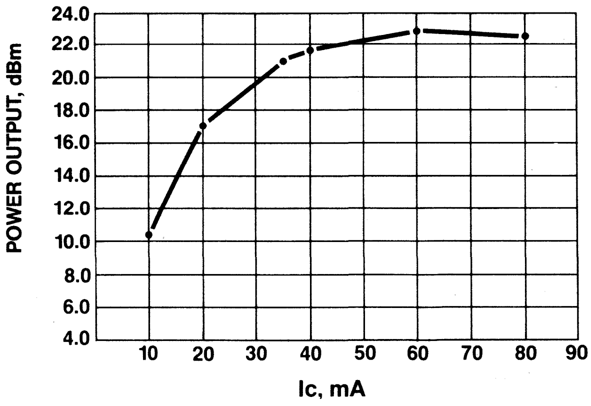
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25° C.
4. Storage above + 150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.



MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY V_{CE} = 8V, I_C = 35 mA



POWER OUTPUT @ 1 dB GAIN COMPRESSION vs. COLLECTOR CURRENT V_{CB} = 8V, FREQUENCY = 2 GHz

TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8.0V, I_C = 35 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.71	179.4	18.45	83.1	.038	45.0	.21	-141.2
1.0	.72	160.5	12.48	63.2	.061	47.8	.20	-171.4
1.5	.74	147.2	9.02	47.9	.085	44.8	.21	172.3
2.0	.77	134.2	6.44	34.0	.104	35.9	.24	159.5
2.5	.79	121.9	4.60	19.4	.121	31.4	.27	150.6
3.0	.81	112.5	2.87	5.8	.140	22.2	.30	142.5
3.5	.81	101.3	1.41	-7.3	.157	16.5	.34	134.7
4.0	.83	93.2	.23	-18.2	.171	8.1	.38	128.8

AT-01670
.1-4 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

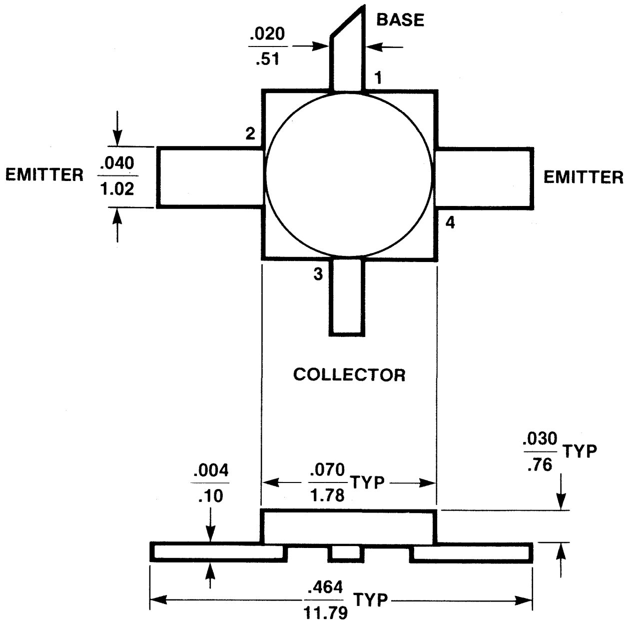
- **Wide Dynamic Range**
- **13 dB $|S_{21}|^2$ @ 1 GHz**
- **22 dBm $P_{1\,dB}$ @ 2 GHz**
- **1 Watt Maximum P_T**
- **High Rel Package**

DESCRIPTION

The AT-01670 is a high gain, medium power silicon bipolar transistor designed for use as an intermediate power linear amplifier at frequencies through 4 GHz. It is fabricated in the high performance 70 mil stripline package; a hermetically sealed high reliability ceramic package having gold plated leads.

This transistor uses nitride self alignment and ion implantation for precise control of emitter and base doping.

Avantek 70 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=35 mA	0.5 GHz 1.0 GHz 2.0 GHz	dB	 12.0 	19.0 13.0 7.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=35 mA	1.0 GHz 2.0 GHz	dB		18.0 12.0	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz	dBm		22.0	
$G_{1\,dB}$	1 dB Compressed Gain, V_{CE} = 8.0V, I_C = 60 mA		dB		10.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 10 mA	1.0 GHz	dB		2.5	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 35 mA			30	100	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		1.0	

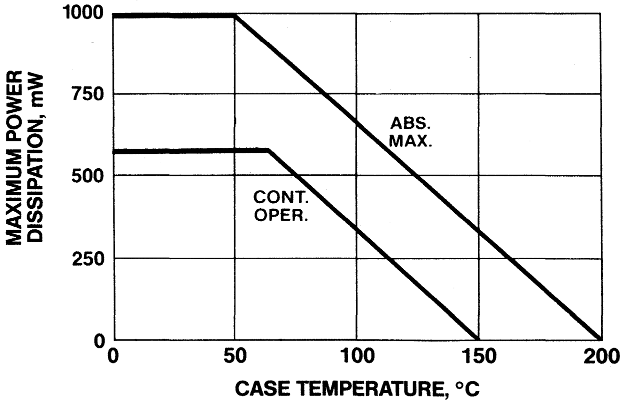
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	90 mA	150 mA
Continuous Dissipation[3]	P_T	600 mW	1000 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

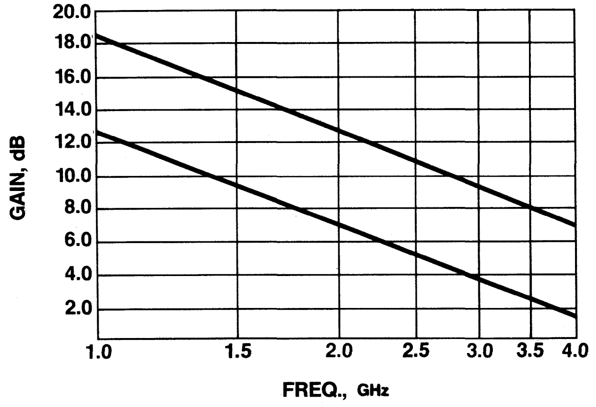
Thermal Resistance, θ_{jc}: 150°C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

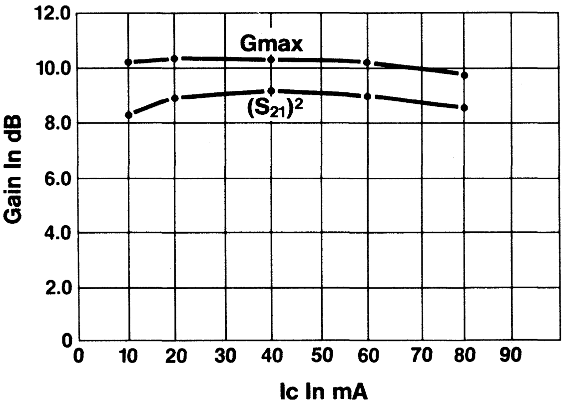
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
V_{CE} = 8V, I_C = 35 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 1.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 35 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.5	.78	-177.0	18.92	85.4	.031	37.1	.26	-147.0
1.0	.79	168.7	12.97	67.2	.046	43.5	.24	-172.7
1.5	.80	159.2	9.56	53.4	.062	43.4	.25	174.2
2.0	.81	149.5	7.03	40.7	.080	40.1	.27	163.6
2.5	.82	139.7	5.28	28.0	.088	30.6	.29	158.6
3.0	.82	132.3	3.58	14.7	.105	25.5	.32	151.8
3.5	.81	123.3	2.30	2.3	.118	20.7	.36	145.7
4.0	.81	116.5	1.06	-8.5	.129	13.2	.40	141.1

AT-01672
.06-1 GHz General Purpose Silicon Bipolar Transistor Summary Data

FEATURES

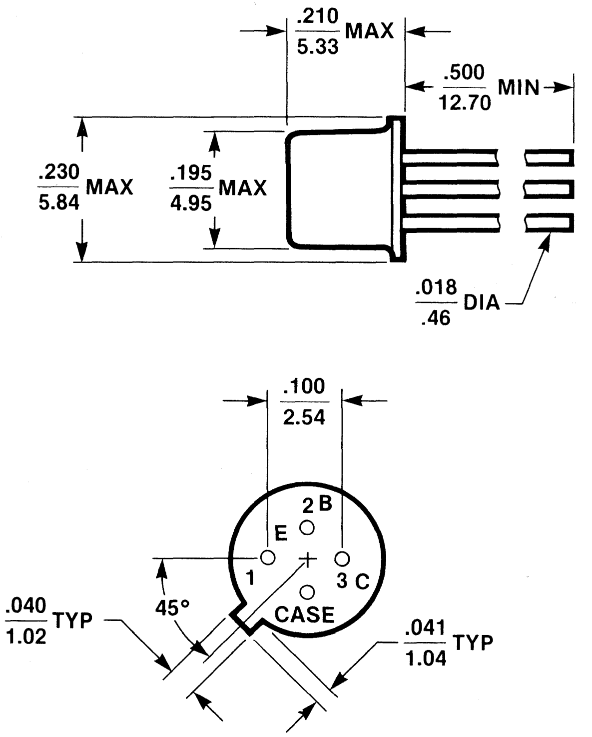
- **Wide Dynamic Range**
- **14 dB $|S_{21}|^2$ @ 500 GHz**
- **23 dBm $P_{1\,dB}$ @ 1 GHz**
- **1 db Noise Figure @ 60 MHz**
- **High Rel Package**

DESCRIPTION

The AT-01672 is a high gain, medium power silicon bipolar transistor designed for use as an intermediate power linear amplifier at frequencies through 1 GHz. It is fabricated in the TO-72 package; a hermetically sealed high reliability industry standard metal package.

This transistor uses nitride self alignment and ion implantation for precise control of emitter and base doping.

Avantek TO-72 Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=35 mA	0.1 GHz 0.5 GHz 1.0 GHz	dB	 13.0 	26.0 14.0 9.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=35 mA	0.5 GHz 1.0 GHz	dB		15.0 10.0	
$P_{1\,dB}$	Power Output at 1 dB Gain Compression V_{CE} = 8.0V, I_C = 60 mA	1.0 GHz	dBm		23.0	
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 10 mA	0.06 GHz 0.5 GHz	dB		1.0 1.4	
h_{FE}	Forward Current Transfer Ratio, V_{CE} = 8.0V, I_C = 35 mA			30	100	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		0.5	

RECOMMENDED MAXIMUM RATINGS

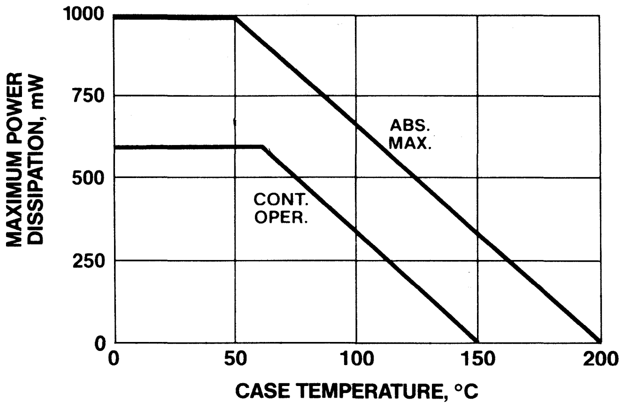
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	90 mA	150 mA
Continuous Dissipation[3]	P_T	600 mW	1000 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 150°C/W

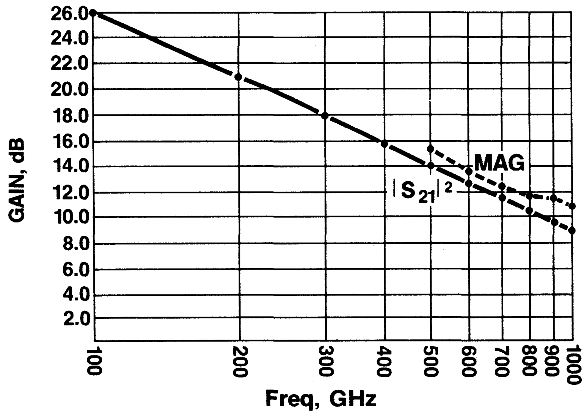
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

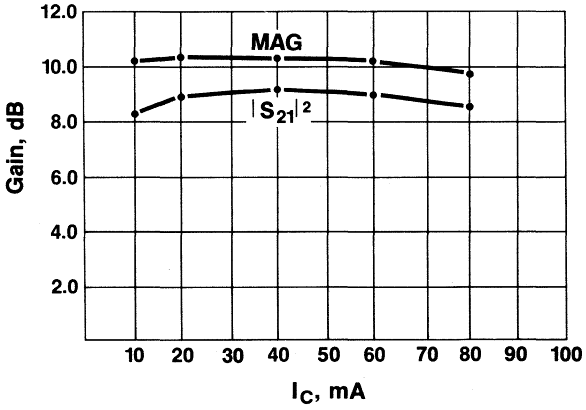
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY V_{CE} = 8V, I_C = 35 mA



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT FREQ. = 1.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8.0V, I_C = 35 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
0.1	.333	-75.1	26.501	114.3	.033	71.6	.490	-39.3
0.2	.222	-106.7	21.657	99.0	.056	71.6	.338	-42.7
0.3	.178	-127.3	18.370	91.9	.079	71.6	.274	-41.1
0.4	.161	-144.2	15.953	85.5	.099	71.2	.231	-39.3
0.5	.159	-157.7	14.121	80.6	.118	70.7	.196	-40.4
0.6	.158	-167.5	12.694	77.0	.140	69.4	.172	-46.2
0.7	.159	-174.2	11.595	73.2	.161	68.2	.167	-55.4
0.8	.160	179.6	10.559	68.4	.185	66.7	.181	-63.0
0.9	.161	173.3	9.766	64.4	.206	64.5	.199	-67.4
1.0	.164	167.3	8.908	60.2	.226	62.8	.209	-67.8

AT-41410
.1-6 GHz Low Noise Silicon Bipolar Transistor

FEATURES

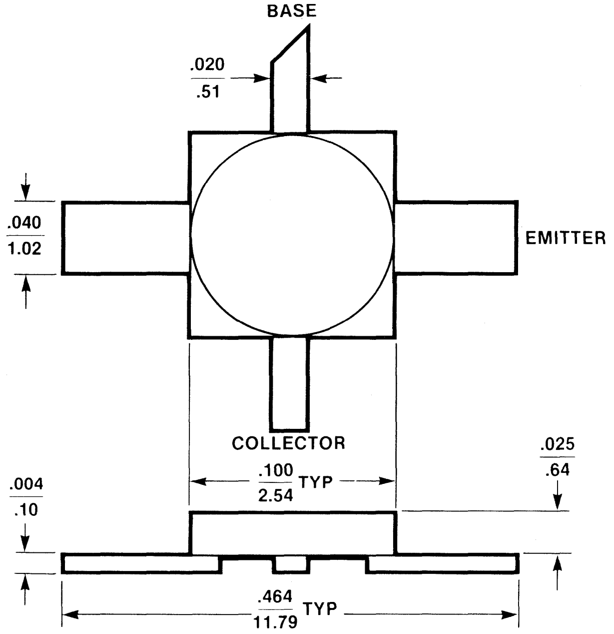
- **1.6 dB NF_O max. @ 2 GHz**
- **14.0 dB G_A min. @ 2 GHz**
- **12.5 dB $|S_{21}|^2$ @ 2 GHz**
- **6.5 dB $|S_{21}|^2$ Typ. @ 4 GHz**
- **17.5 dB MAG @ 2.0 GHz**
- **Hermetic Package**

DESCRIPTION

The AT-41410 is a low noise, high gain, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 6 GHz and maintain high gain at most operating currents which results in a very wide dynamic range. Furthermore, this transistor is assembled in the high performance, 100 mil stripline package, a hermetic ceramic package using gold-plated leads.

AVANTEK 100 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 10$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure	1.0 GHz	dB		1.3	
		2.0			1.6	1.9
		4.0			3.0	
G_A	Gain @ NF_O	1.0 GHz	dB		19.0	
		2.0		13.0	14.0	
		4.0			10.5	
MAG	Maximum Available Gain, $V_{CE} = 8V$, $I_C = 25$ mA	2.0 GHz	dB		17.5	
$P_{1\,dB}$	Power out @ 1 dB Gain Compression	4.0 GHz	dBm		19.0	
$G_{1\,dB}$	1 dB Compressed Gain: $V_{CE} = 8V$, $I_C = 25$ mA		dB		9.5	
h_{FE}	Forward Current Transfer Ratio: $V_{CE} = 8V$, $I_C = 10$ mA			30	100	300
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		μA			.20
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		μA			1.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 8V$, Freq. = 1 MHz		pF		0.23	

RECOMMENDED MAXIMUM RATINGS

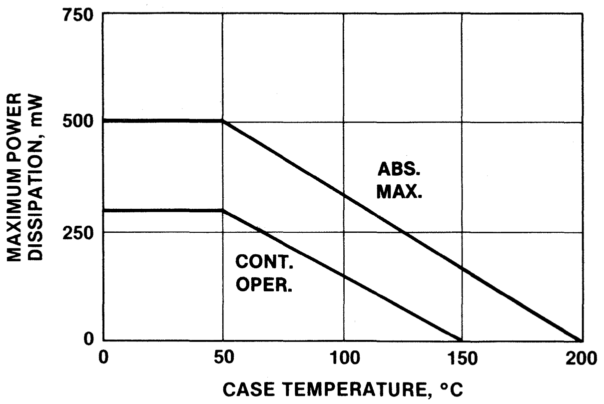
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	30 mA	60 mA
Continuous Dissipation[3]	P_T	300 mW	500 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 250°C/W

Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 10 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.66	– 124	22.3	12.98	108	– 28.7	.037	41	.58	– 39
1.0	.65	– 162	17.3	7.28	83	– 27.1	.044	33	.44	– 46
1.5	.65	177	14.1	5.07	66	– 26.3	.048	35	.39	– 52
2.0	.65	163	11.7	3.83	54	– 25.0	.056	36	.37	– 60
2.5	.66	151	9.8	3.08	41	– 23.9	.064	36	.37	– 69
3.0	.67	139	8.6	2.68	28	– 22.6	.074	36	.38	– 80
3.5	.66	130	7.0	2.23	16	– 21.5	.084	34	.38	– 92
4.0	.69	121	6.0	1.99	6	– 20.5	.094	32	.39	– 103
5.0	.70	103	4.4	1.67	– 15	– 18.1	.124	26	.42	– 127
6.0	.73	86	2.7	1.36	– 36	– 16.2	.155	16	.47	– 150

V_{CE} = 8V, I_C = 25 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.61	– 147	23.6	15.20	100	– 31.6	.026	44	.45	– 43
1.0	.63	– 175	18.2	8.10	79	– 29.1	.035	46	.34	– 45
1.5	.63	168	14.9	5.55	64	– 27.1	.044	48	.31	– 51
2.0	.64	156	12.5	4.20	52	– 25.1	.056	48	.30	– 59
2.5	.65	146	10.5	3.35	40	– 23.5	.067	46	.30	– 69
3.0	.66	135	9.3	2.91	28	– 22.0	.080	43	.31	– 80
3.5	66	127	7.7	2.42	16	– 20.8	.091	39	.31	– 92
4.0	.69	118	6.7	2.17	6	– 19.8	.103	36	.32	– 103
5.0	.70	101	5.2	1.82	– 15	– 17.5	.133	27	.35	– 127
6.0	.72	84	3.5	1.50	– 35	– 15.7	.163	16	.41	– 150

AT-41435-3
.1-6 GHz Low Noise Silicon Bipolar Transistor

FEATURES

- **1.3 dB Noise Figure @ 1.0 GHz**
- **1.6 dB Typ., 1.9 dB Max, N_F @ 2.0 GHz**
- **19.0 dB Associated Gain @ 1.0 GHz**
- **14.0 dB Typ., 13.0 dB Min., G_A @ 2.0 GHz**
- **16 dB Maximum Available Gain @ 2.0 GHz**
- **Low Cost micro-X package**

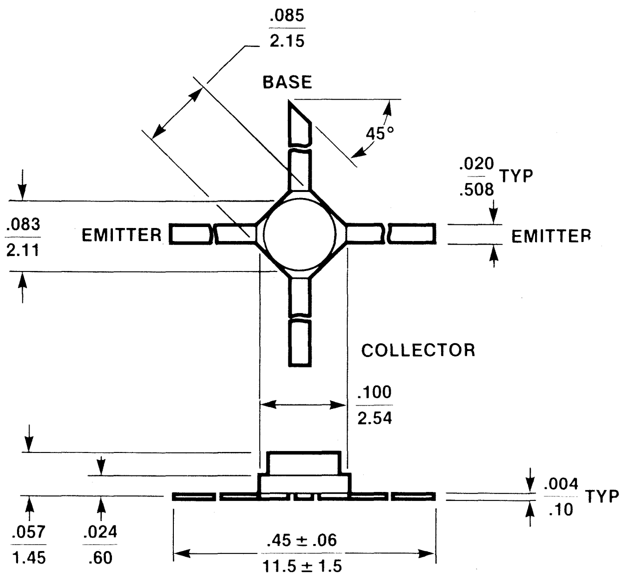
DESCRIPTION

The AT-41435-3 is a low noise, high gain, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 6 GHz and maintain a low noise figure at any operating current which results in a very wide dynamic range.

This transistor is fabricated in the high performance, low price, micro-X package; a hermetic ceramic package using tin-plated leads.

AVANTEK micro-X PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 10$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure	1.0 GHz	dB		1.3	
		2.0			1.6	1.9
		4.0			3.0	
G_A	Gain @ NF_O	1.0 GHz	dB		19.0	
		2.0		13.0	14.0	
		4.0			10.0	
MAG	Maximum Available Gain	2.0 GHz	dB		16.0	
$P_{1\,dB}$	Power out @ 1 dB Gain Compression	4.0 GHz	dBm		19.0	
$G_{1\,dB}$	1 dB Compressed Gain: $V_{CE} = 8V$, $I_C = 25$ mA		dB		9.5	
h_{FE}	Forward Current Transfer Ratio: $V_{CE} = 8V$, $I_C = 10$ mA			30	100	300
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		µA			.20
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		µA			1.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 8V$, Freq. = 1 MHz		pF		0.18	

RECOMMENDED MAXIMUM RATINGS

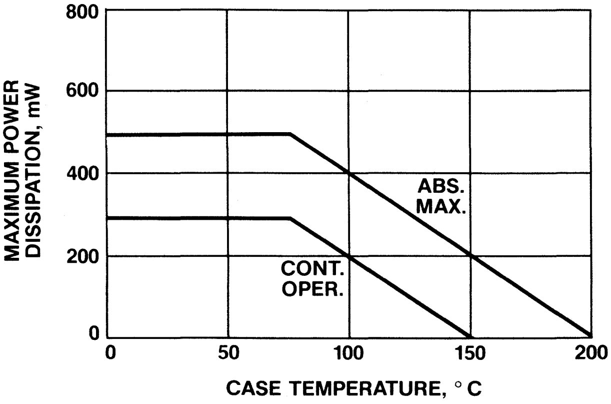
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	30 mA	60 mA
Continuous Dissipation[3]	P_T	300 mW	500 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature[4]	T_{STG}	− 65° C to 150° C	200° C

Thermal Resistance, θ_{jc}: 250° C/W

Notes:

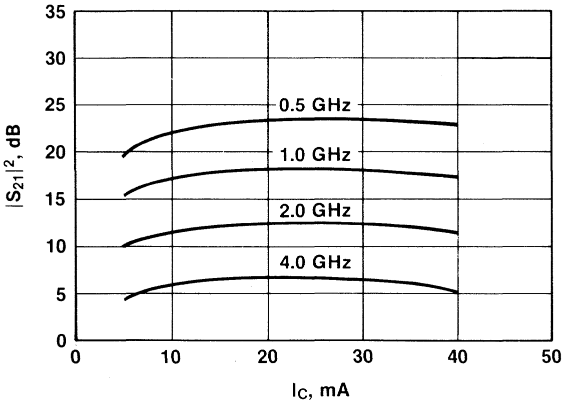
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.
4. Storage above + 150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

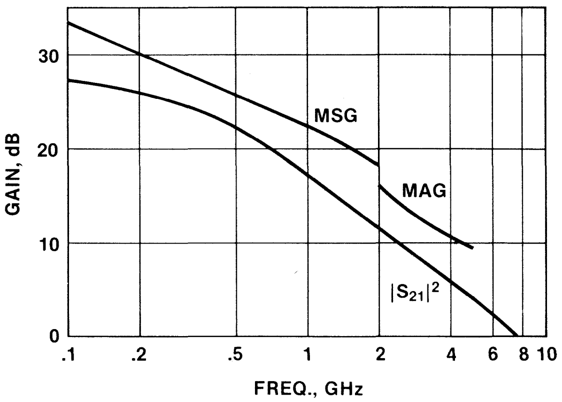


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

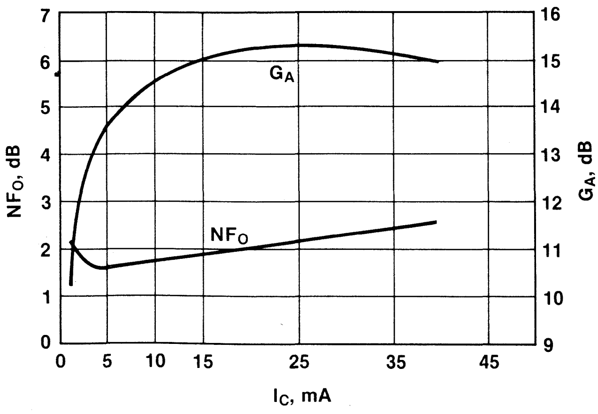
INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
$V_{CE} = 8V$



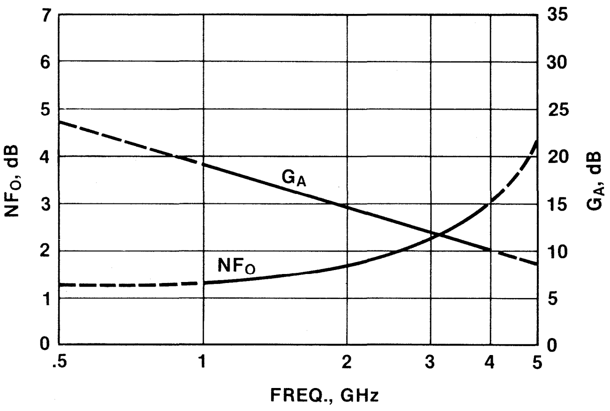
INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA



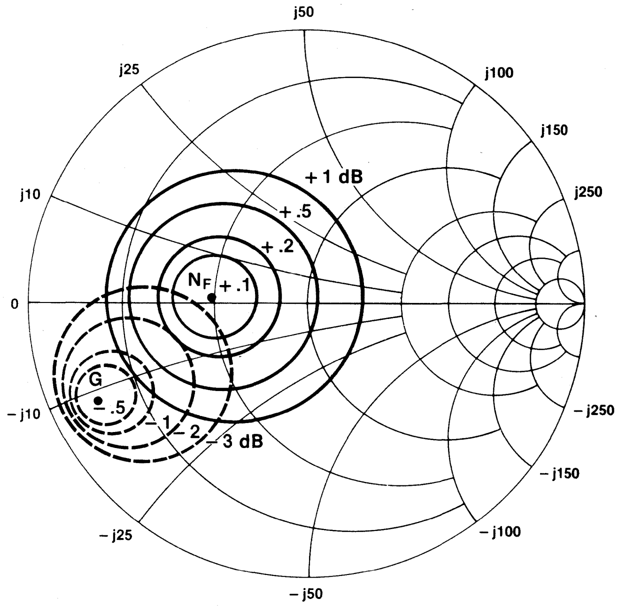
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. CURRENT
FREQUENCY = 2.0 GHz, $V_{CE} = 8V$



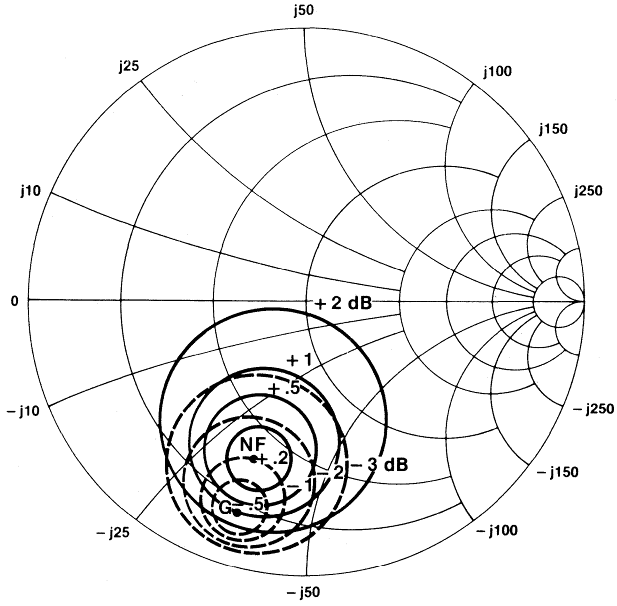
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA



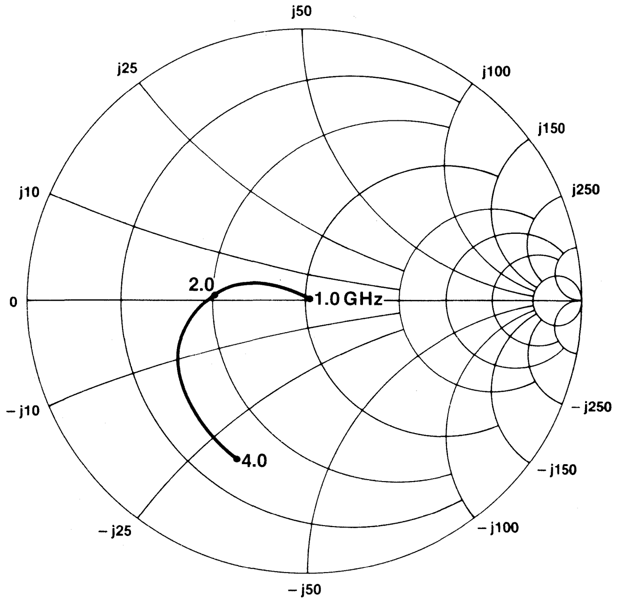
CONSTANT NOISE FIGURE AND GAIN
vs. SOURCE IMPEDANCE
FREQUENCY = 2 GHz, $V_{CE} = 8V$, $I_C = 10$ mA
$NF_O = 1.71$ dB, $\Gamma_O = .35, +177$
MAG = 16.3 dB, $\Gamma_{ms} = .84, -160$



CONSTANT NOISE FIGURE AND GAIN
vs. SOURCE IMPEDANCE
FREQUENCY = 4 GHz, $V_{CE} = 8V$, $I_C = 10$ mA
$NF_O = 2.98$, $\Gamma_O = .64, -111$
MAG = 10.6 dB, $\Gamma_{ms} = .84, -111$



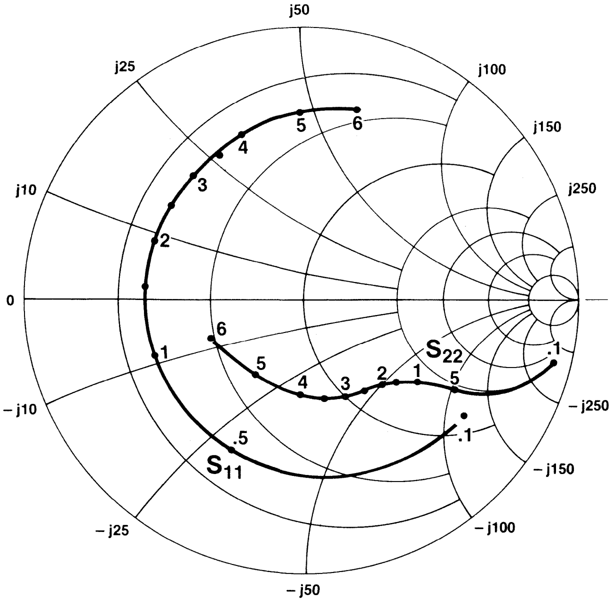
OPTIMUM REFLECTION COEFFICIENT
vs. FREQUENCY
$V_{CE}8V$, $I_C = 10$ mA



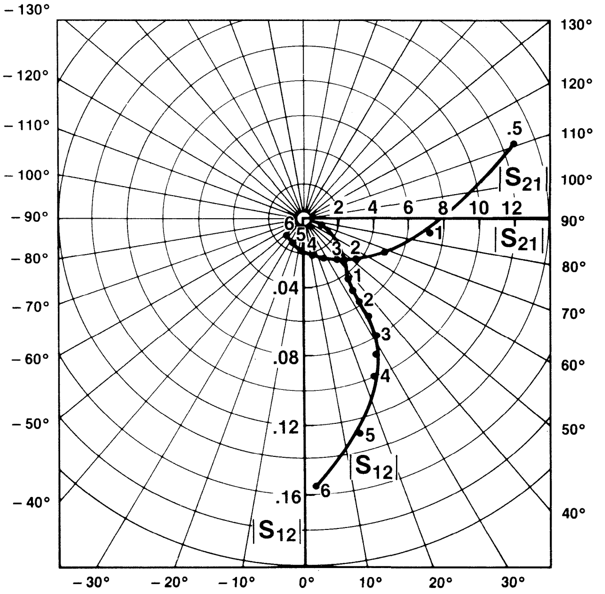
NOISE PARAMETERS vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA

Freq. GHz	NF_O dB	G_A dB	$NF_{50\,\Omega}$ dB	Γ_O Mag	Ang	R_N Ω
1.0	1.27	19.3	1.32	.05	+ 30	84.4
2.0	1.71	14.0	2.13	.35	+ 177	6.5
4.0	2.98	10.0	5.36	.64	– 111	42.0

INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA



FORWARD AND REVERSE TRANSMISSION COEFFICIENT vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V$, $I_C = 10$ mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	.72	– 37	27.2	23.03	157	– 39.2	.011	70	.94	– 15
0.5	.62	– 116	22.1	12.73	110	– 29.4	.034	44	.64	– 32
1.0	.58	– 159	17.2	7.26	84	– 27.3	.043	36	.51	– 37
1.5	.57	175	14.0	5.03	66	– 26.2	.049	36	.45	– 43
2.0	.58	158	11.6	3.82	53	– 24.7	.058	35	.43	– 50
2.5	.59	144	9.7	3.05	40	– 23.3	.068	33	.41	– 58
3.0	.61	131	8.4	2.64	26	– 22.0	.079	31	.40	– 69
3.5	.61	120	6.8	2.19	13	– 21.0	.089	27	.38	– 80
4.0	.65	110	5.8	1.96	2	– 20.0	.100	23	.36	– 93
5.0	.68	91	4.1	1.60	– 20	– 17.8	.129	14	.34	– 123
6.0	.72	74	2.2	1.29	– 42	– 16.1	.156	2	.37	– 157

$V_{CE} = 8V$, $I_C = 25$ mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	.54	– 60	31.2	36.16	149	– 40.0	.010	64	.87	– 20
0.5	.55	– 139	23.4	14.75	101	– 31.7	.026	47	.54	– 33
1.0	.55	– 173	18.0	7.94	79	– 28.9	.036	46	.43	– 36
1.5	.56	166	14.7	5.42	63	– 26.7	.046	46	.40	– 42
2.0	.57	152	12.3	4.11	51	– 24.6	.059	45	.38	– 48
2.5	.59	139	10.3	3.28	38	– 23.0	.071	41	.36	– 57
3.0	.61	127	9.0	2.83	25	– 21.6	.083	37	.35	– 67
3.5	.61	117	7.4	2.34	13	– 20.4	.095	31	.33	– 79
4.0	.64	108	6.4	2.09	2	– 19.4	.107	26	.31	– 92
5.0	.68	89	4.7	1.72	– 20	– 17.3	.137	15	.29	– 123
6.0	.71	73	2.8	1.39	– 41	– 15.7	.164	1	.31	– 158

AT-41435-5
.1-6 GHz General Purpose Silicon Bipolar Transistor

FEATURES

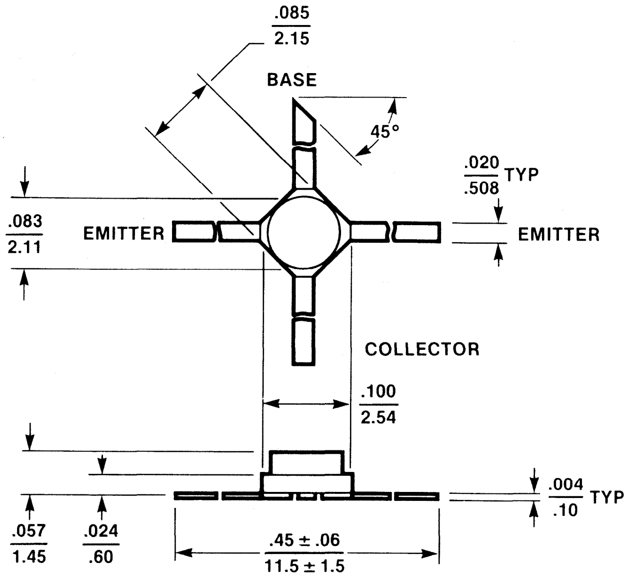
- 12.5 dB $|S_{21}|^2$ at 2 GHz
- 6.5 dB $|S_{21}|^2$ Typ. at 4 GHz
- 11.0 dB MAG at 4 GHz
- Low cost micro-X package
- Low Price, High Volume

DESCRIPTION

The AT-41435-5 is a low noise, high gain, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 6 GHz and maintain high gain at most operating currents which results in a very wide dynamic range. Furthermore, this transistor is fabricated in the high performance, low price micro-x package, a hermetic ceramic package using tin-plated leads.

AVANTEK micro-X PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 25$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$|S_{21}|^2$	Insertion Power Gain	1.0 GHz	dB		18.0	
		2.0			12.5	
		4.0		5.5	6.5	
MAG	Maximum Available Gain	2.0 GHz	dB		16.5	
		4.0			11.0	
$P_{1\,dB}$	Power out at 1 dB Gain Compression	4.0 GHz	dBm		19.0	
$G_{1\,dB}$	1 dB Compressed Gain		dB		9.5	
NF_O	Optimum Noise Figure: $I_C = 10$ mA	4.0 GHz	dB		3.1	
G_A	Associated Gain at NF_O				10.0	
h_{FE}	Forward Current Transfer Ratio: $V_{CE} = 8V$, $I_C = 10$ mA			30	100	300
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		μA			.20
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		μA			1.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 8V$, Freq. = 1 MHz		pF		0.18	

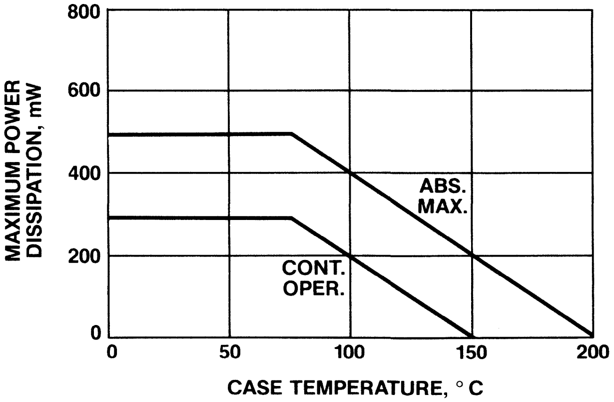
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	30 mA	60 mA
Continuous Dissipation[3]	P_T	300 mW	500 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature[4]	T_{STG}	− 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 250°C/W

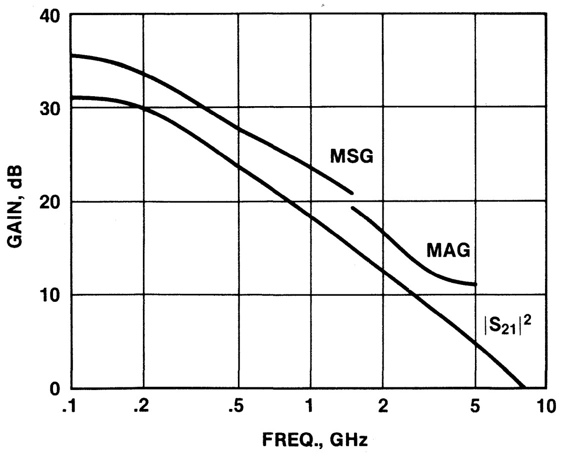
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.
4. Storage above + 150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

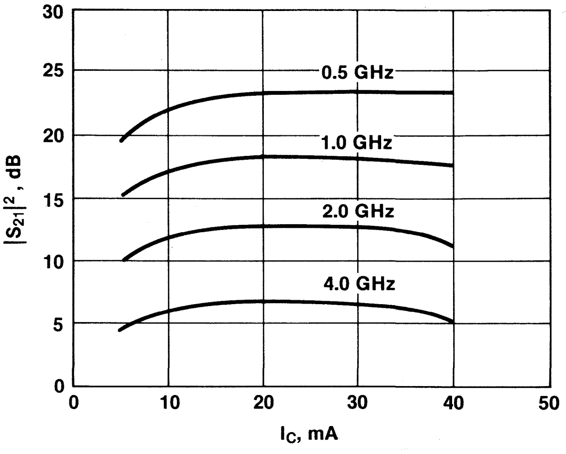


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

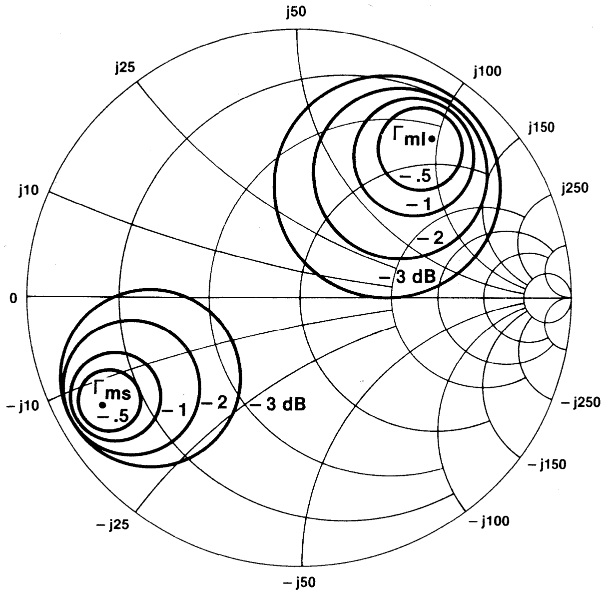
INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA



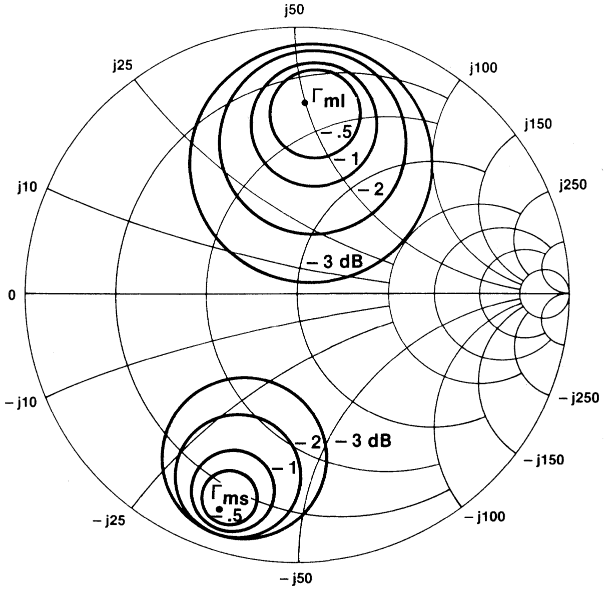
INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
$V_{CE} = 8V$



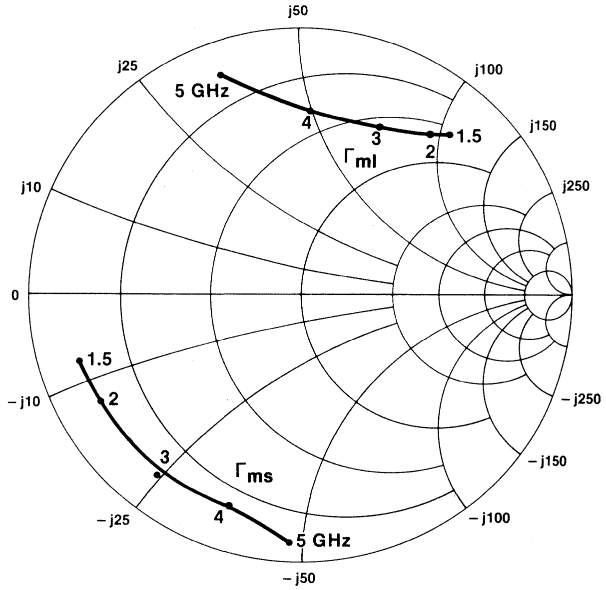
SOURCE AND LOAD REFLECTION COEFFICIENTS FOR CONSTANT GAIN FREQ. = 2 GHz, $V_{CE} = 8V$, $I_C = 25$ mA



SOURCE AND LOAD REFLECTION COEFFICIENTS FOR CONSTANT GAIN FREQ. = 4 GHz, $V_{CE} = 8V$, $I_C = 25$ mA



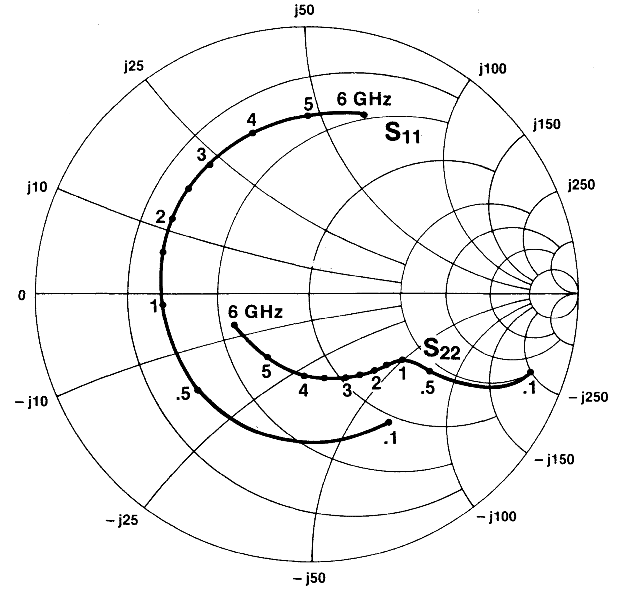
CONJUGATE MATCH SOURCE AND LOAD REFLECTION COEFFICIENTS vs FREQUENCY (K > 1) $V_{CE} = 8V$, $I_C = 25$ mA



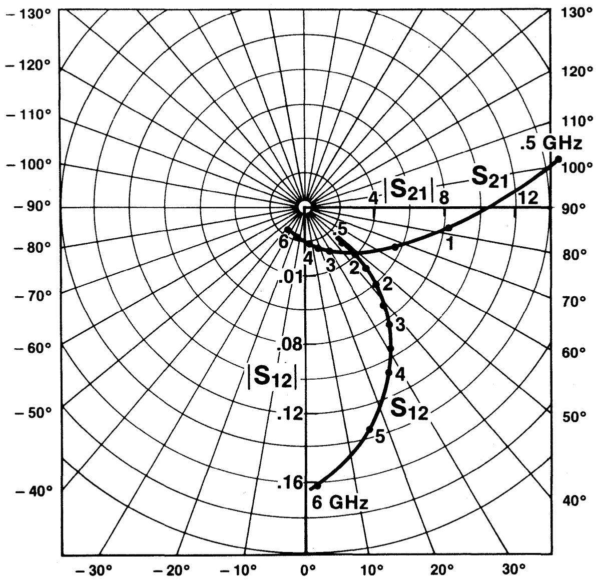
GAIN PARAMETERS vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA

Freq. GHz	$\|S_{21}\|^2$ dB	MAG (MSG) dB	K	Γms ρ	Γms θ	Γml ρ	Γml θ
1	18.0	(23.4)	0.92	—	—	—	—
1.5	14.7	19.2	1.06	.85	− 163	.80	47
2	12.3	16.5	1.10	.83	− 151	.76	51
4	6.4	10.9	1.11	.85	− 109	.72	87

INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA



FORWARD AND REVERSE TRANSMISSION COEFFICIENT vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V$, $I_C = 10$ mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	.72	−37	27.2	23.03	157	−39.2	.011	70	.94	−15
0.5	.62	−116	22.1	12.73	110	−29.4	.034	44	.64	−32
1.0	.58	−159	17.2	7.26	84	−27.3	.043	36	.51	−37
1.5	.57	175	14.0	5.03	66	−26.2	.049	36	.45	−43
2.0	.58	158	11.6	3.82	53	−24.7	.058	35	.43	−50
2.5	.59	144	9.7	3.05	40	−23.3	.068	33	.41	−58
3.0	.61	131	8.4	2.64	26	−22.0	.079	31	.40	−69
3.5	.61	120	6.8	2.19	13	−21.0	.089	27	.38	−80
4.0	.65	110	5.8	1.96	2	−20.0	.100	23	.36	−93
5.0	.68	91	4.1	1.60	−20	−17.8	.129	14	.34	−123
6.0	.72	74	2.2	1.29	−42	−16.1	.156	2	.37	−157

$V_{CE} = 8V$, $I_C = 25$ mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Mag	S_{21} Ang	S_{12} dB	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.1	.54	−60	31.2	36.16	149	−40.0	.010	64	.87	−20
0.5	.55	−139	23.4	14.75	101	−31.7	.026	47	.54	−33
1.0	.55	−173	18.0	7.94	79	−28.9	.036	46	.43	−36
1.5	.56	166	14.7	5.42	63	−26.7	.046	46	.40	−42
2.0	.57	152	12.3	4.11	51	−24.6	.059	45	.38	−48
2.5	.59	139	10.3	3.28	38	−23.0	.071	41	.36	−57
3.0	.61	127	9.0	2.83	25	−21.6	.083	37	.35	−67
3.5	.61	117	7.4	2.34	13	−20.4	.095	31	.33	−79
4.0	.64	108	6.4	2.09	2	−19.4	.107	26	.31	−92
5.0	.68	89	4.7	1.72	−20	−17.3	.133	15	.29	−123
6.0	.71	73	2.8	1.39	−41	−15.7	.164	1	.31	−158

AT-41470
.1-6 GHz Low Noise Silicon Bipolar Transistor

FEATURES

- **1.3 dB Noise Figure @ 1.0 GHz**
- **1.6 dB Typ., 1.9 dB Max, N_F @ 2.0 GHz**
- **19.0 dB Associated Gain @ 1.0 GHz**
- **14.0 dB Typ., 13.0 dB Min., G_A @ 2.0 GHz**
- **16.5 dB Maximum Available Gain @ 2.0 GHz**
- **Hermetic Stripline Package**

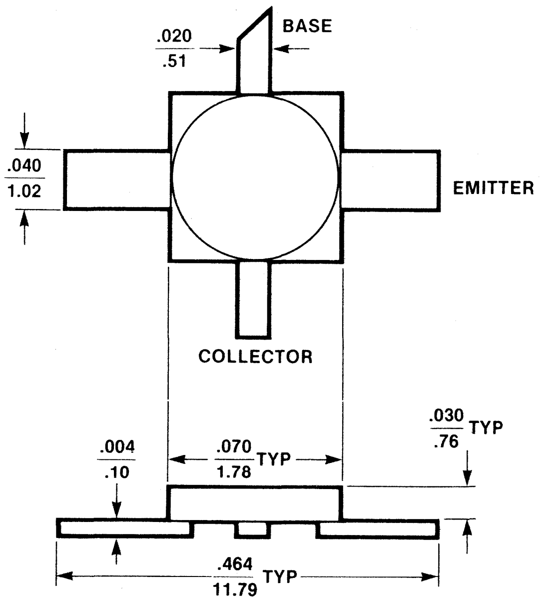
DESCRIPTION

The AT-41470 is a low noise, high gain, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 6 GHz and maintain a low noise figure at any operating current which results in a very wide dynamic range.

This transistor is fabricated in the high performance, stripline, 70 mil package; a hermetic high reliability ceramic package using gold-plated leads.

AVANTEK 70 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 10$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure	1.0 GHz	dB		1.3	
		2.0 GHz			1.6	1.9
		4.0 GHz			3.0	
G_A	Gain @ NF_O	1.0 GHz	dB		19.0	
		2.0 GHz		13.0	14.0	
		4.0 GHz			10.5	
MAG	Maximum Available Gain	2.0 GHz	dB		16.5	
$P_{1\,dB}$	Power out @ 1 dB Gain Compression	4.0 GHz	dBm		19.0	
$G_{1\,dB}$	1 dB Compressed Gain: $V_{CE} = 8V$, $I_C = 25$ mA		dB		9.5	
h_{FE}	Forward Current Transfer Ratio: $V_{CE} = 8V$, $I_C = 10$ mA			30	100	300
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		μA			.20
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		μA			1.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 8V$, Freq. = 1 MHz		pF		0.18	

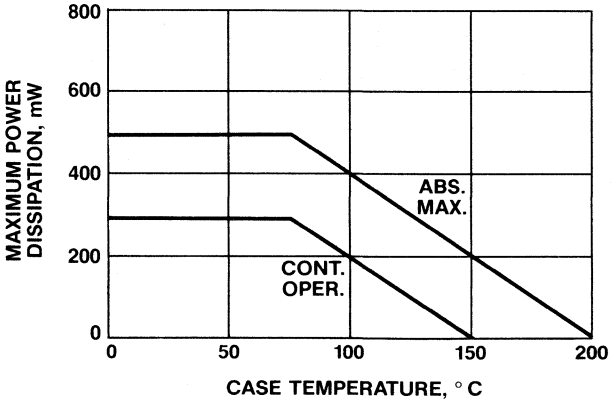
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	30 mA	60 mA
Continuous Dissipation[3]	P_T	300 mW	500 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	− 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 250°C/W

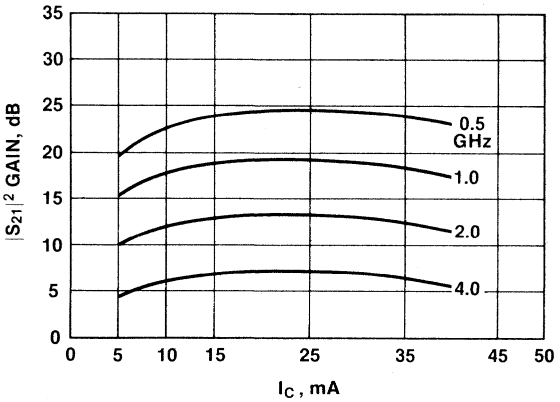
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

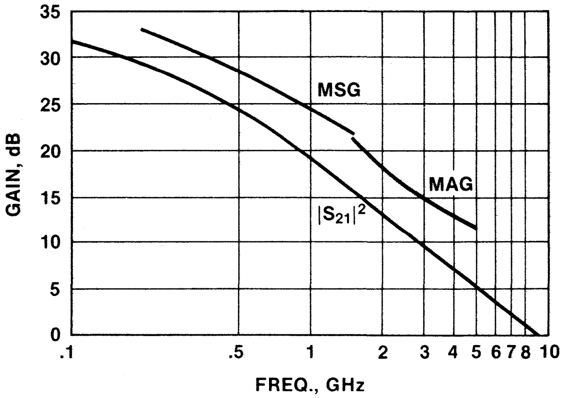


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

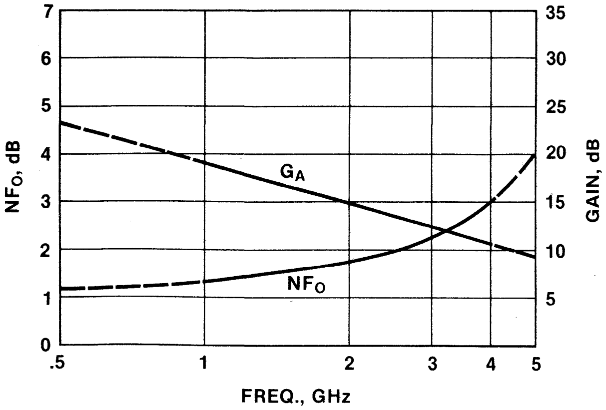
INSERTION POWER GAIN vs. COLLECTOR CURRENT AND FREQUENCY
$V_{CE} = 8V$



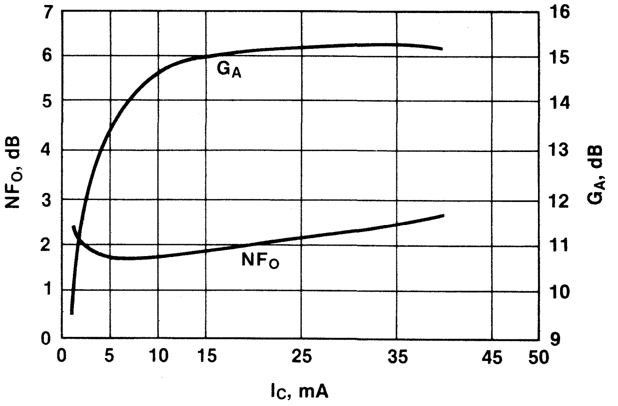
INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN, AND MAXIMUM STABLE GAIN vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA

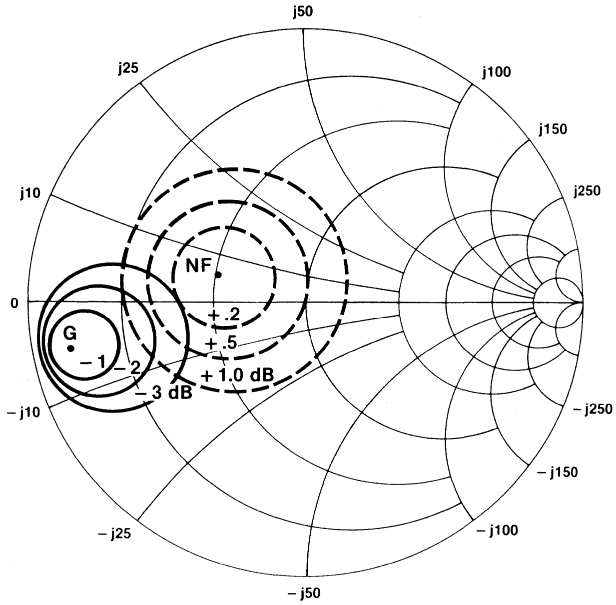


OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 10$ mA

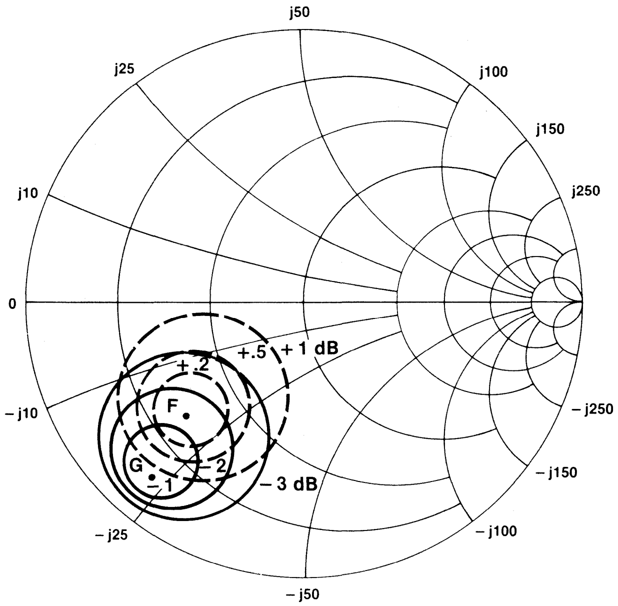


OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. COLLECTOR CURRENT
FREQUENCY = 2 GHz, $V_{CE} = 8V$

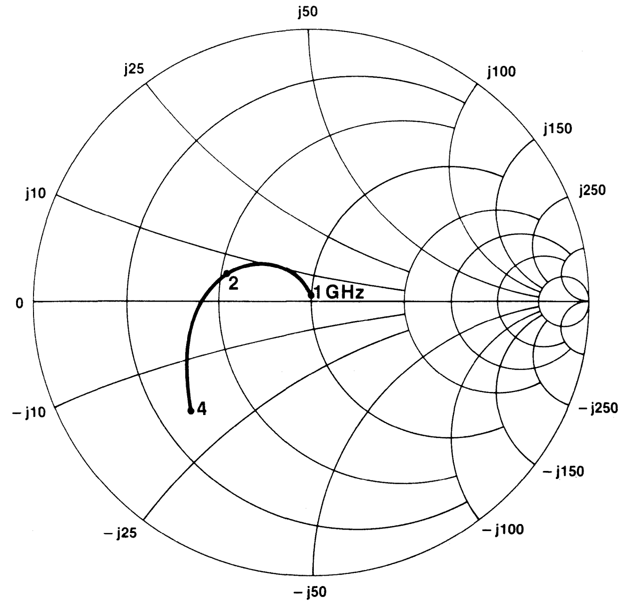




CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE
FREQUENCY = 2 GHz, V_{CE} = 8V, I_C = 10 mA



CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE
FREQUENCY = 4 GHz, V_{CE} = 8V, I_C = 10 mA



OPTIMUM REFLECTION COEFFICIENT vs. FREQUENCY
V_{CE} = 8V, I_C = 10 mA

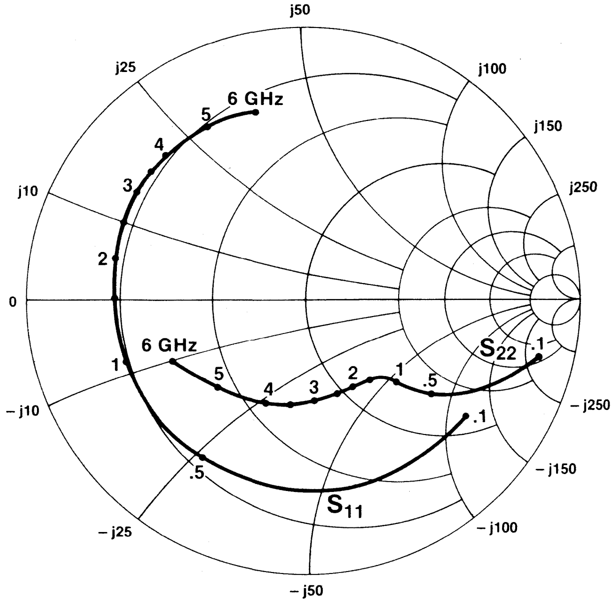
NOISE PARAMETERS vs. FREQUENCY
V_{CE} = 8V, I_C = 10 mA

Freq. GHz	NF_O dB	G_A dB	$NF_{50\,\Omega}$ dB	Γ_O Mag	Γ_O Ang	R_N Ω
1.0	1.32	19.0	1.37	.05	+ 15	86.3
2.0	1.74	14.0	2.26	.32	+ 164	11.3
4.0	2.98	10.5	5.08	.60	− 137	20.9

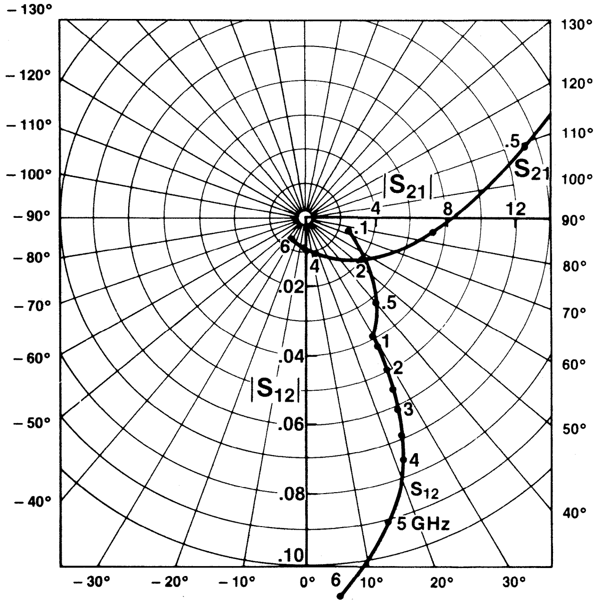
GAIN PARAMETERS vs. FREQUENCY
V_{CE} = 8V, I_C = 25 mA

Freq. GHz	$\|S_{21}\|^2$ dB	K	MAG (MSG) dB	Γ_{ms} Mag	Γ_{ms} Ang	Γ_{ml} Mag	Γ_{ml} Ang
1.0	18.8	0.83	(24.5)	—	—	—	—
1.5	15.5	1.03	21.0	.92	− 169	.86	54
2.0	13.0	1.09	18.1	.88	− 159	.76	60
4.0	7.0	1.13	12.3	.87	− 129	.73	100
5.0	5.3	1.02	11.7	.94	− 116	.88	121
6.0	3.5	0.98	(10.9)	—	—	—	—

INPUT AND OUTPUT REFLECTION COEFFICIENT
vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA



FORWARD AND REVERSE TRANSMISSION COEFFICIENT
vs. FREQUENCY
$V_{CE} = 8V$, $I_C = 25$ mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V$, $I_C = 10$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.76	–35	27.5	23.84	159	–37.7	.013	74	.93	–13
0.5	.68	–119	22.3	13.01	112	–29.1	.035	39	.61	–36
1.0	.64	–157	17.2	7.33	86	–27.7	.041	31	.47	–41
1.5	.64	–175	14.1	5.06	70	–26.7	.046	32	.42	–48
2.0	.65	172	11.7	3.86	59	–25.7	.052	34	.39	–54
2.5	.65	159	9.9	3.13	47	–24.6	.059	35	.38	–63
3.0	.67	146	8.9	2.79	31	–24.3	.061	26	.39	–80
3.5	.68	138	7.2	2.29	19	–23.3	.068	23	.39	–93
4.0	.70	131	6.2	2.03	9	–22.6	.074	21	.40	–106
5.0	.70	116	4.5	1.68	–12	–20.7	.092	15	.44	–131
6.0	.70	101	2.6	1.35	–32	–19.2	.110	5	.50	–153

$V_{CE} = 8V$, $I_C = 25$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.59	–60	31.8	38.85	150	–39.2	.011	65	.86	–19
0.5	.62	–146	23.9	15.66	102	–32.8	.023	42	.46	–39
1.0	.65	–172	18.8	8.71	81	–30.2	.031	41	.38	–41
1.5	.66	171	15.5	5.95	66	–28.6	.037	42	.34	–47
2.0	.67	160	13.1	4.49	54	–26.7	.046	42	.32	–56
2.5	.68	151	11.1	3.57	43	–25.2	.055	39	.31	–67
3.0	.69	142	9.8	3.08	31	–23.9	.064	36	.32	–80
3.5	.68	135	8.1	2.53	19	–22.9	.072	31	.32	–94
4.0	.70	128	7.0	2.25	10	–21.9	.080	28	.33	–107
5.0	.70	113	5.4	1.85	–11	–19.9	.101	19	.38	–132
6.0	.70	99	3.5	1.49	–30	–18.4	.120	7	.44	–154

AT-41472
0.1-1 GHz Low Noise Silicon Bipolar Transistor Summary Data

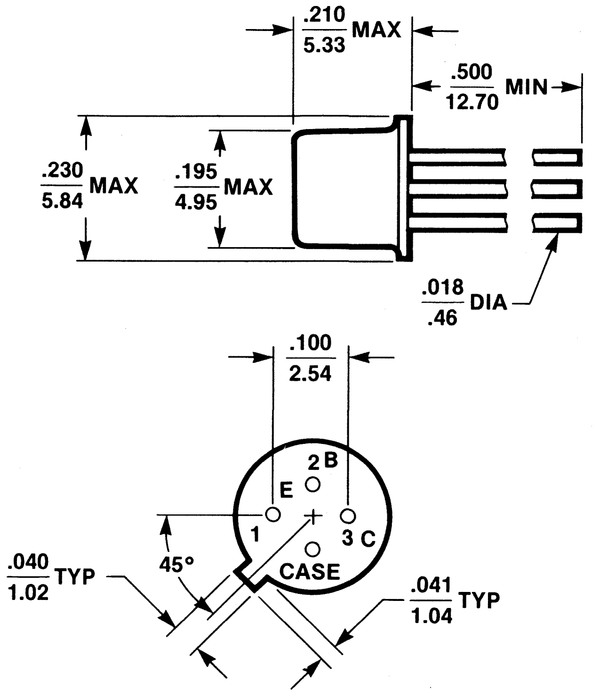
FEATURES
- 1.2 dB NF @ 500 MHz
- 22 dB MSG @ 500 MHz
- 21 dB $P_{1\ dB}$ @ 500 MHz
- Hermetic TO-72
- Wide Dynamic Range

DESCRIPTION

The AT-41472 is a low noise, high gain, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 1 GHz and maintain a low noise figure at high operating current which results in a very wide dynamic range.

AVANTEK TO-72 PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_{OPT}	Optimum Noise Figure, $V_{CE} = 8V$, $I_C = 4$ mA	0.1 GHz 0.5 GHz 1.0 GHz	dB		1.1 1.2 1.8	 1.4
$\|S_{21}\|^2$	Insertion Power Gain, $V_{CE} = 8V$, $I_C = 25$ mA	0.5 GHz	dB		17	
MSG	Maximum Stable Gain, $V_{CE} = 8V$, $I_C = 25$ mA	0.5 GHz	dB		22	
P_{1dB}	Power Output at 1 dB Gain Compression	0.5 GHz	dBm		21	
$G_{1\ dB}$	1 dB Compressed Gain: $V_{CE} = 8V$, $I_C = 25$ mA		dB		9.0	
h_{FE}	Forward Current Transfer Ratio: $V_{CE} = 8V$, $I_C = 10$ mA			30	100	300
I_{CBO}	Collector Cutoff Current, $V_{CB} = 8V$		μA			0.2
I_{EBO}	Emitter Cutoff Current, $V_{EB} = 1V$		μA			1.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 8V$ Freq. = 1 MHz		pF		0.30	

RECOMMENDED MAXIMUM RATINGS, $T_A = 25°C$

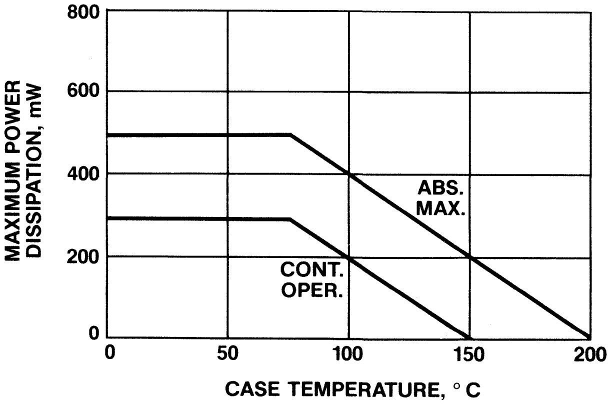
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	30 mA	60 mA
Continuous Dissipation[3]	P_T	300 mW	500 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature	T_{STG}	— 65° C to 150° C	200° C

Thermal Resistance, θ_{jc}: 250° C/W

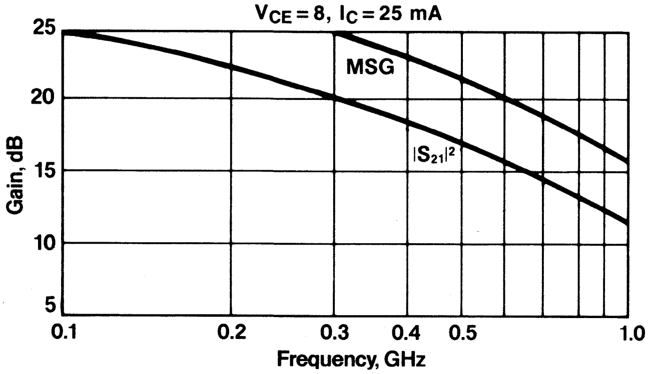
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. $T_{CASE} = 25° C$.

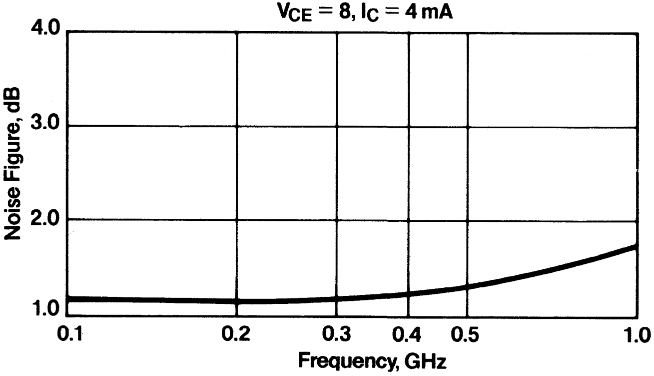
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM STABLE GAIN (MSG) AND INSERTION POWER GAIN ($|S_{21}|^2$) VS. FREQUENCY
$V_{CE} = 8$, $I_C = 25$ mA



NOISE FIGURE (NF_O) VS. FREQUENCY
$V_{CE} = 8$, $I_C = 4$ mA



S-PARAMETERS, MAGNITUDES AND ANGLES

$V_{CE} = 8$, $I_C = 4$ mA

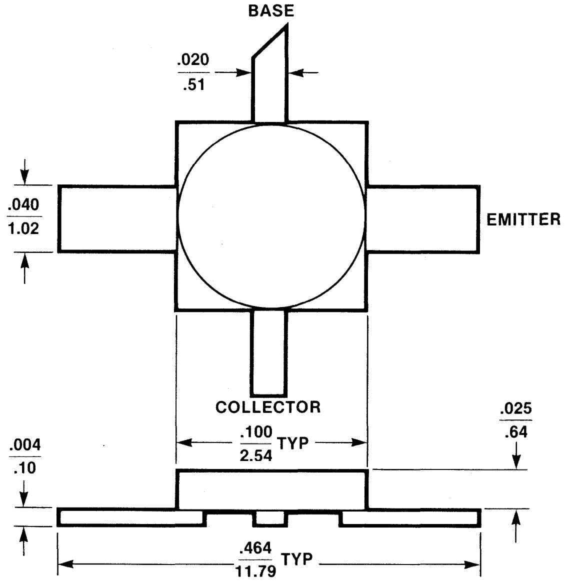
FREQ	S11		S21		S12		S22	
MHz	MAG	ANGLE	dB	ANGLE	MAG	ANGLE	MAG	ANGLE
100.00	.874	−21.2	20.18	154.8	.018	80.6	.963	−9.4
200.00	.740	−37.6	18.87	138.2	.030	74.3	.879	−15.9
300.00	.614	−50.1	17.39	124.5	.039	67.9	.816	−19.2
400.00	.509	−58.8	16.02	114.9	.047	64.2	.763	−21.3
500.00	.425	−65.8	14.62	106.1	.054	64.0	.718	−23.6
600.00	.358	−72.1	13.52	99.8	.063	62.6	.689	−26.7
700.00	.316	−78.0	12.63	94.1	.068	62.5	.665	−30.1
800.00	.275	−83.0	11.55	88.9	.075	64.3	.662	−33.0
900.00	.244	−86.4	10.87	84.7	.080	65.2	.676	−34.9
1000.00	.217	−89.3	10.01	79.3	.085	66.9	.680	−36.2

$V_{CE} = 8$, $I_C = 25$ mA

FREQ	S11		S21		S12		S22	
MHz	MAG	ANGLE	dB	ANGLE	MAG	ANGLE	MAG	ANGLE
100.00	.524	−28.2	27.73	132.0	.014	81.5	.826	−14.7
200.00	.379	−39.1	24.00	112.8	.025	77.0	.714	−17.1
300.00	.298	−41.3	21.16	102.7	.036	78.2	.661	−17.7
400.00	.248	−41.0	18.99	96.1	.046	76.2	.629	−18.5
500.00	.217	−40.5	17.17	90.2	.056	77.1	.605	−20.2
600.00	.199	−40.4	15.79	86.3	.066	74.8	.585	−23.2
700.00	.185	−40.5	14.57	82.5	.077	73.7	.576	−27.0
800.00	.175	−40.2	13.47	79.2	.086	73.8	.580	−30.1
900.00	.168	−39.6	12.57	75.7	.096	73.6	.595	−32.8
1000.00	.161	−40.8	11.78	72.6	.103	73.1	.604	−34.9

AT-42010
.1-6 GHz Medium Power Silicon Bipolar Transistor Summary Data

AVANTEK 100 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

FEATURES

- 21 dBm $P_{1\ dB}$ @ 2 GHz
- 38% Efficiency
- 11.5 dB $|S_{21}|^2$ Gain @ 2 GHz
- 16 dB MAG @ 2 GHz
- 3.0 dB Noise Figure @ 2 GHz

DESCRIPTION

The AT-42010 is a high gain, medium power, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This device will operate up to 6 GHz and maintain high gain at high operating currents which results in a very wide dynamic range. Furthermore, this transistor is assembled in the high performance, 100 mil stripline package, a hermetic package using gold plated leads.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 35$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Forward Transmission Coefficient	2.0 GHz	dB	10.5	11.5	
MAG	Maximum Available Gain	2.0 GHz	dB		16.0	
$G_{1\ dB}$	1 dB Gain Compression Point	2.0 GHz	dB		14.0	
$P_{1\ dB}$	Power Out @ 1 dB Gain Compression	2.0 GHz	dBm		21.0	
NF_O	Optimum Spot Noise Figure	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio			30	100	250
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		μA			0.3
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		μA			2.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 10V$, Freq. = 1 MHz		pF		.20	

RECOMMENDED MAXIMUM RATINGS

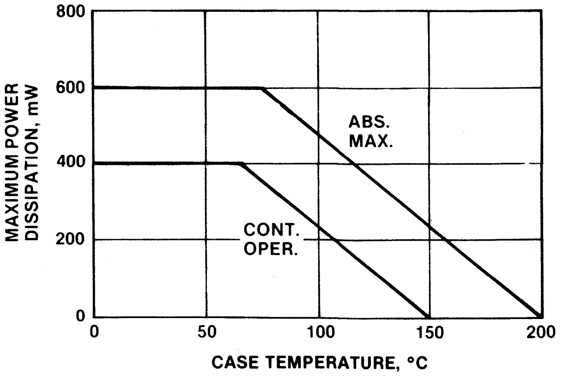
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	50 mA	80 mA
Continuous Dissipation[3]	P_T	400 mW	600 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	– 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 200°C/W

Notes:

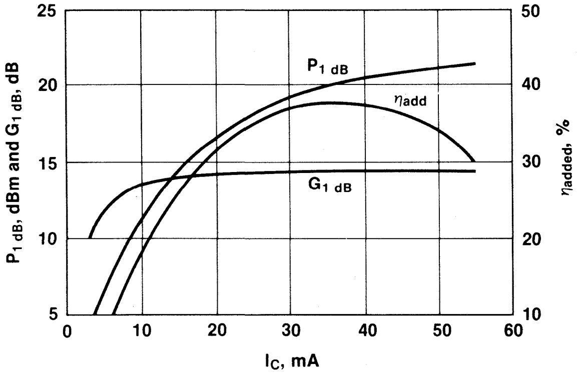
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



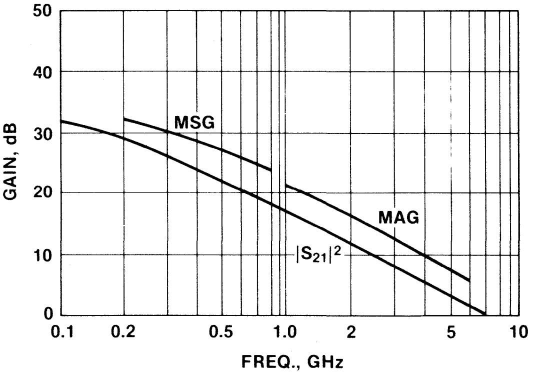
COMPRESSED GAIN (1 dB), POWER OUTPUT & POWER ADDED EFFICIENCY vs. COLLECTOR CURRENT

V_{CE} = 8V, FREQ., = 2.0 GHz



INSERTION POWER GAIN, MAX. AVAILABLE GAIN, & MAX. STABLE GAIN vs. FREQUENCY

V_{CE} = 8V, I_C = 35 mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 35 mA

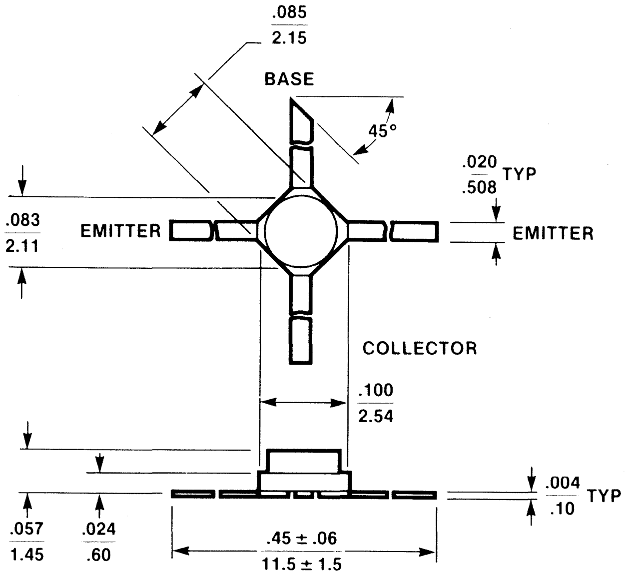
Freq.	S11		S21			S12			S22	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.44	– 70	31.7	38.5	145	– 45.1	.01	77	.81	– 22
0.5	.53	– 159	22.8	13.8	96	– 32.3	.02	63	.38	– 39
1.0	.56	176	17.2	7.3	76	– 28.0	.04	55	.30	– 39
1.5	.57	160	13.8	4.9	61	– 25.3	.05	52	.27	– 43
2.0	.59	147	11.4	3.7	48	– 23.1	.07	48	.25	– 50
3.0	.62	124	8.0	2.5	23	– 20.0	.10	36	.23	– 69
4.0	.66	106	5.3	1.8	0	– 18.2	.12	23	.21	– 93
5.0	.69	89	3.5	1.5	– 21	– 16.3	.15	12	.21	– 120
6.0	.71	72	1.6	1.2	– 42	– 15.1	.18	– 1	.23	– 155

AT-42035
.1-6 GHz Medium Power Silicon Bipolar Transistor

FEATURES

- 21 dBm $P_{1\,dB}$ @ 2 GHz
- 38% Efficiency
- 11.5 dB $|S_{21}|^2$ Gain @ 2 GHz
- 16 dB MAG @ 2 GHz
- 3.0 dB Noise Figure @ 2 GHz
- Low Cost micro-X Package

AVANTEK micro-X PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

DESCRIPTION

The AT-42035 is a high gain, medium power, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This transistor is fabricated in the high performance, low cost, micro-X package; a hermetic, ceramic package using tin-plated leads.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 35$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Forward Transmission Coefficient	2.0 GHz	dB	10.5	11.5	
MAG	Maximum Available Gain	2.0 GHz	dB		16.0	
$G_{1\,dB}$	1 dB Gain Compression Point	2.0 GHz	dB		14.0	
$P_{1\,dB}$	Power Out @ 1 dB Gain Compression	2.0 GHz	dBm		21.0	
NF_O	Optimum Spot Noise Figure	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio			30	100	250
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		μA			0.3
I_{CBO}	Emitter Cutoff Current: $V_{EB} = 1V$		μA			2.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 10V$, Freq. = 1 MHz		pF		.20	

RECOMMENDED MAXIMUM RATINGS

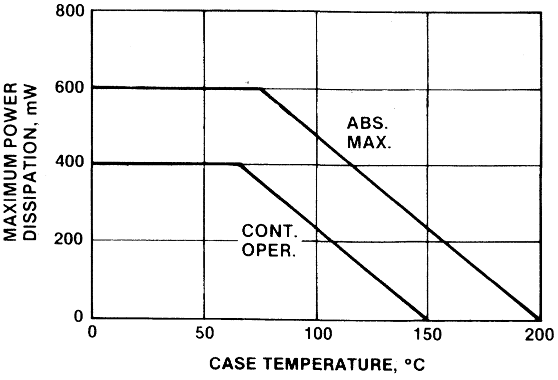
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	50 mA	80 mA
Continuous Dissipation[3]	P_T	400 mW	600 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 250°C/W

Notes:

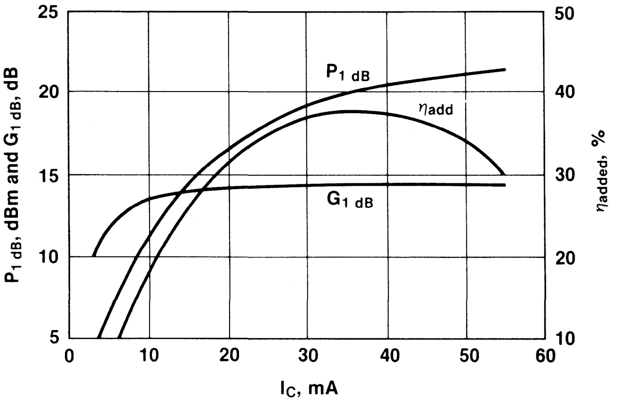
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

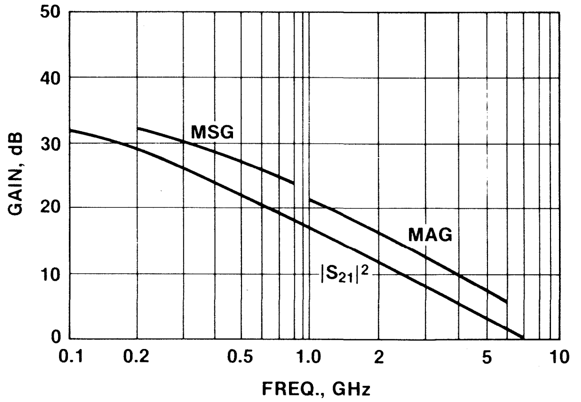


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

COMPRESSED GAIN (1 dB), POWER OUTPUT & POWER ADDED EFFICIENCY vs. COLLECTOR CURRENT $V_{CE} = 8V$, FREQ., = 2.0 GHz



INSERTION POWER GAIN, MAX. AVAILABLE GAIN, & MAX. STABLE GAIN vs. FREQUENCY $V_{CE} = 8V$, $I_C = 35$ mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V$, $I_C = 35$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.44	– 70	31.7	38.5	145	– 45.1	.01	77	.81	– 22
0.5	.53	– 159	22.8	13.8	96	– 32.3	.02	63	.38	– 39
1.0	.56	176	17.2	7.3	76	– 28.0	.04	55	.30	– 39
1.5	.57	160	13.8	4.9	61	– 25.3	.05	52	.27	– 43
2.0	.59	147	11.4	3.7	48	– 23.1	.07	48	.25	– 50
3.0	.62	124	8.0	2.5	23	– 20.0	.10	36	.23	– 69
4.0	.66	106	5.3	1.8	0	– 18.2	.12	23	.21	– 93
5.0	.69	89	3.5	1.5	– 21	– 16.3	.15	12	.21	– 120
6.0	.71	72	1.6	1.2	– 42	– 15.1	.18	– 1	.23	– 155

AT-42070
.1-6 GHz Medium Power Silicon Bipolar Transistor

FEATURES

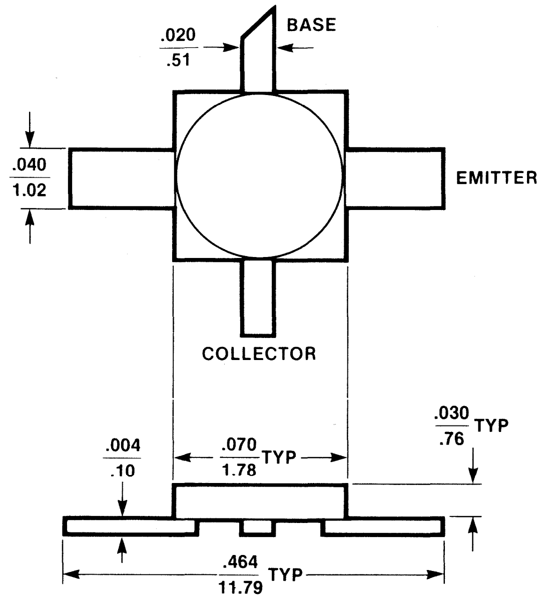
- **21 dBm $P_{1\,dB}$ @ 2 GHz**
- **38% Efficiency**
- **11.5 dB $|S_{21}|^2$ Gain @ 2 GHz**
- **17.0 dB MAG @ 2 GHz**
- **3.0 dB Noise Figure @ 2 GHz**

DESCRIPTION

The AT-42070 is a high gain, medium power, silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with 1 micrometer thick gold and passivated with silicon nitride.

This transistor is fabricated in the high performance, 70 mil stripline package, a hermetic, high reliability, ceramic package using gold-plated leads.

AVANTEK 70 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{CE} = 8V$, $I_C = 35$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max
$\|S_{21}\|^2$	Forward Transmission Coefficient	2.0 GHz	dB		11.5	
MAG	Maximum Available Gain	2.0 GHz	dB		17.0	
$P_{1\,dB}$	Power Out @ 1 dB Gain Compression	2.0 GHz	dBm	20.0	21.0	
$G_{1\,dB}$	1 dB Gain Compression Point	2.0 GHz	dB	13.5	15.0	
NF_O	Optimum Spot Noise Figure	2.0 GHz	dB		3.0	
h_{FE}	Forward Current Transfer Ratio			30	100	250
I_{CBO}	Collector Cutoff Current: $V_{CB} = 8V$		µA			0.3
I_{EBO}	Emitter Cutoff Current: $V_{EB} = 1V$		µA			2.0
C_{CB}	Collector Base Capacitance: $V_{CB} = 10V$, Freq. = 1 MHz		pF		.25	

RECOMMENDED MAXIMUM RATINGS

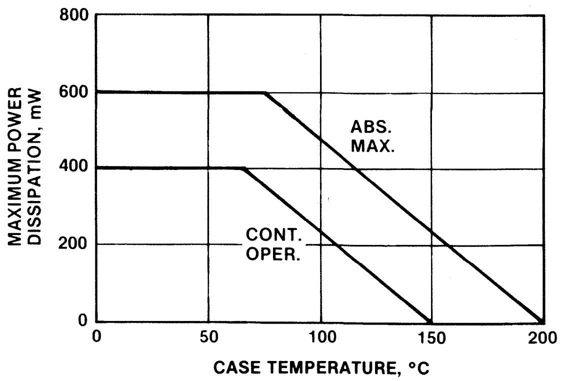
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	50 mA	80 mA
Continuous Dissipation[3]	P_T	400 mW	600 mW
Junction Temperature	T_j	150° C	200° C
Storage Temperature	T_{STG}	– 65° C to 150° C	200° C

Thermal Resistance, θ_{jc}: 250° C/W

Notes:

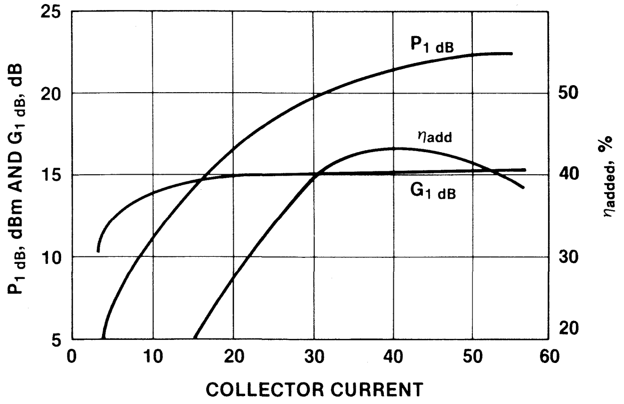
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. $T_{CASE} = 25°C$.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

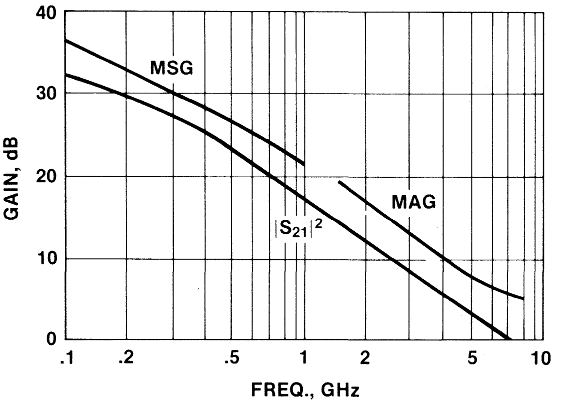


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

COMPRESSED GAIN (1 dB), POWER OUTPUT & POWER ADDED EFFICIENCY vs. COLLECTOR CURRENT $V_{CE} = 8V$, FREQUENCY = 2.0 GHz



INSERTION POWER GAIN, MAX. AVAILABLE GAIN, & MAX. STABLE GAIN vs. FREQUENCY $V_{CE} = 8V$, $I_C = 35$ mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V$, $I_C = 35$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.1	.45	– 72	32.1	40.38	145	– 43.1	.007	75	.80	– 22
0.5	.57	– 150	23.2	14.49	96	– 32.1	.025	61	.38	– 35
1.0	.64	– 177	17.6	7.60	76	– 28.4	.038	52	.33	– 39
1.5	.65	168	14.2	5.15	63	– 26.3	.048	51	.31	– 43
2.0	.66	157	11.8	3.91	50	– 24.0	.063	48	.27	– 52
3.0	.68	139	8.4	2.64	25	– 22.2	.077	35	.26	– 70
4.0	.69	123	5.7	1.93	20	– 20.8	.091	21	.26	– 94
5.0	.70	109	4.0	1.58	– 20	– 19.2	.109	13	.27	– 118
6.0	.70	95	2.0	1.26	– 40	– 18.1	.124	2	.30	– 154

AT-60510
.1-6 GHz General Purpose Silicon Bipolar Transistor Summary Data

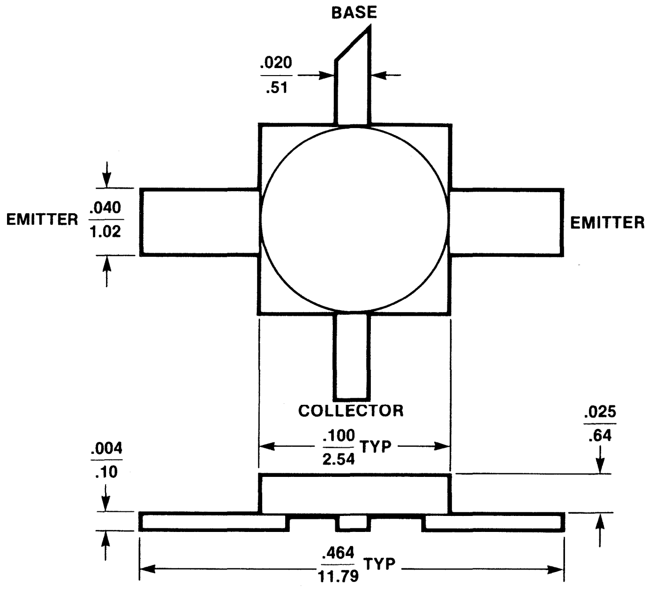
FEATURES

- **Low Current Operation**
- **1.6 dB NF_O @ 2 GHz**
- **12 dB G_A @ 2 GHz**
- **12 dB $|S_{21}|^2$ @ 2 GHz**
- **Hermetic Stripline Package**

DESCRIPTION

The AT-60510 is a low noise, high gain, low current silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with one micrometer thick gold and passivated with silicon nitride. This transistor is fabricated in the high performance, 100 mil stripline package, a hermetic ceramic package using gold-plated leads.

Avantek 100 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure, V_{CE} = 8.0V, I_C = 2.0 mA	1.0 GHz 2.0 GHz 4.0 GHz	dB		1.3 1.6 2.8	 2.1
G_A	Associated Gain at NF_O	1.0 GHz 2.0 GHz 4.0 GHz	dB	 11.0 	16.0 12.0 8.0	
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE} = 8.0V, I_C = 10 mA	2.0 GHz 4.0 GHz	dB		12.0 6.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=10 mA	4.0 GHz	dB		11.0	
h_{FE}	Forward Current Transfer Ratio V_{CE} = 8.0 V, I_C = 4.0 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		.14	

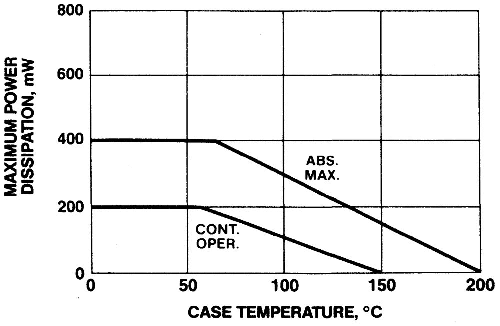
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage[3]	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	20 mA	40 mA
Continuous Dissipation[3]	P_T	200 mW	400 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	− 65°C to 150°C	200°C

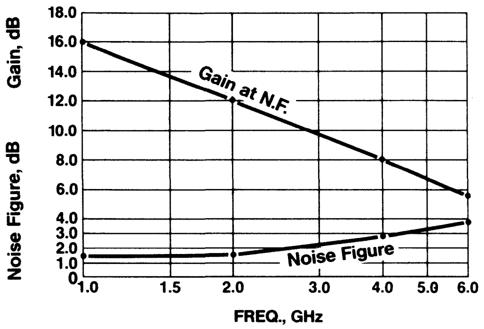
Thermal Resistance, θ_{jc}: 300°C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25°C.

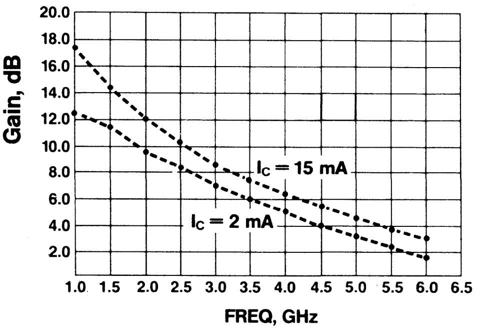
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 2 mA



INSERTION POWER GAIN $|S_{21}|^2$ vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8.0V, I_C = 2.0 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.76	-86.4	12.15	111.0	.076	38.7	.80	-33.9
1.5	.68	-119.9	10.59	89.4	.087	25.1	.71	-45.7
2.0	.63	-145.4	8.98	70.7	.091	15.7	.65	-52.8
2.5	.59	-169.3	7.81	54.0	.098	11.7	.63	-62.8
3.0	.59	172.8	6.47	38.0	.101	1.4	.59	-73.2
3.5	.58	157.8	5.42	25.4	.097	-.9	.57	-81.9
4.0	.57	143.7	4.45	13.4	.095	-3.2	.57	-93.1
4.5	.58	133.5	3.63	.8	.097	-2.7	.57	-103.3
5.0	.59	122.8	2.83	-11.7	.102	-5.6	.59	-116.3
5.5	.60	111.9	2.03	-24.1	.111	-5.6	.60	-129.4
6.0	.59	102.2	1.37	-33.5	.117	-8.2	.62	-141.1

V_{CE} = 8.0V, I_C = 10 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.52	-164.1	17.33	82.7	.033	44.8	.55	-30.7
1.5	.53	176.5	14.19	67.5	.041	46.9	.52	-38.4
2.0	.53	162.7	11.78	54.1	.052	46.8	.50	-44.7
2.5	.56	150.0	10.12	41.5	.066	43.9	.50	-55.7
3.0	.57	138.6	8.50	28.8	.073	36.3	.47	-65.7
3.5	.58	128.3	7.34	18.1	.083	35.6	.47	-74.8
4.0	.58	118.4	6.27	7.8	.093	32.0	.47	-86.8
4.5	.59	110.8	5.36	-3.9	.106	29.8	.48	-97.8
5.0	.60	102.8	4.57	-15.5	.119	22.9	.50	-111.4
5.5	.61	93.9	3.74	-26.7	.136	18.3	.50	-124.8
6.0	.62	85.5	3.12	-35.5	.148	11.6	.53	-137.1

AT-60535
.1-6 GHz Low Noise
Silicon Bipolar Transistor
Summary Data

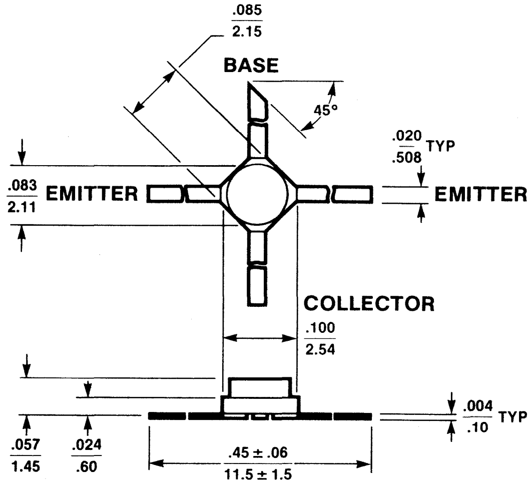
FEATURES

- **Low Current Operation**
- **1.6 dB NF_O @ 2 GHz**
- **12 dB G_A @ 2 GHz**
- **11 dB $|S_{21}|^2$ @ 2 GHz**
- **Low Cost micro-X Package**

DESCRIPTION

The AT-60535 is a low noise, high gain, low current silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transisitor chip is metalized with one micrometer thick gold and passivated with silicon nitride. This transistor is packaged in the high performance, low price, hermetic, ceramic micro-X package which has tin-plated leads.

Avantek micro-X Package



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure, $V_{CE} = 8.0V$, $I_C = 2.0$ mA	1.0 GHz	dB		1.3	
		2.0 GHz			1.6	2.1
		4.0 GHz			2.8	
G_A	Associated Gain at NF_O	1.0 GHz	dB		16.0	
		2.0 GHz		11.0	12.0	
		4.0 GHz			7.0	
$\|S_{21}\|^2$	Insertion Power Gain, $V_{CE} = 8V$, $I_C = 10$ mA	2.0 GHz	dB		11.0	
		4.0 GHz			5.5	
MAG	Maximum Available Gain, $V_{CE}=8.0V$, $I_C=10$ mA	4.0 GHz	dB		10.5	
h_{FE}	Forward Current Transfer Ratio $V_{CE} = 8.0$ V, $I_C = 4.0$ mA			30	150	300
I_{CBO}	Collector Cutoff Current, $V_{CB} = 8.0V$		uA			0.2
I_{EBO}	Emitter Cutoff Current, $V_{EB} = 1.0V$		uA			2.0
C_{CB}	Collector Base Capacitance, $V_{CB} = 8.0V$	1.0 MHz	pF		.14	

RECOMMENDED MAXIMUM RATINGS

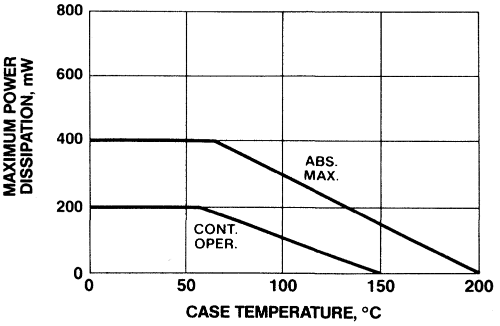
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	20 mA	40 mA
Continuous Dissipation[3]	P_T	200 mW	400 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature[4]	T_{STG}	− 65°C to 150°C	200°C

Thermal Resistance, θ_{jC}: 300°C/W

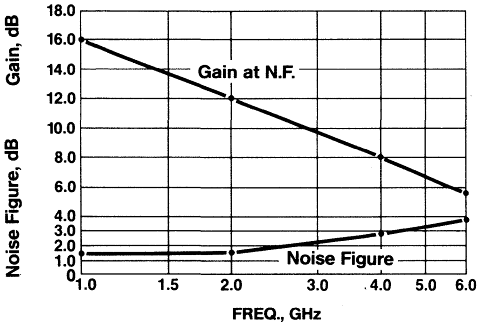
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.
4. Storage above + 150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200°C.

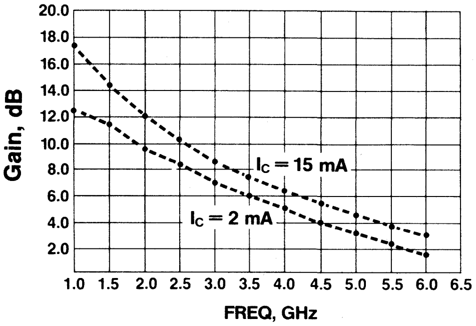
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
V_{CE} = 8V, I_C = 2 mA



INSERTION POWER GAIN $|S_{21}|^2$ vs. COLLECTOR CURRENT AND FREQUENCY
V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE} = 8V, I_C = 2 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.75	-78.6	12.39	114.1	.070	43.0	.83	-29.7
1.5	.63	-112.2	11.00	92.3	.082	30.0	.73	-40.5
2.0	.56	-142.2	9.50	73.1	.088	20.3	.67	-46.3
2.5	.51	-170.8	8.36	55.6	.093	15.9	.65	-54.9
3.0	.51	166.5	7.05	39.1	.103	5.6	.60	-64.5
3.5	.52	138.4	5.95	26.1	.100	2.8	.57	-81.8
4.5	.54	118.9	4.11	-1.0	.103	1.0	.56	-90.5
5.0	.56	107.0	3.30	-11.5	.111	-4.7	.57	-103.3
5.5	.57	95.4	2.49	-24.1	.121	-6.0	.56	-115.7
6.0	.58	85.6	1.86	-33.8	.128	-9.6	.57	-128.0

V_{CE} = 8V, I_C = 10 mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.43	-162.6	17.55	83.2	.033	49.0	.60	-25.9
1.5	.43	173.0	14.36	67.6	.042	49.9	.57	-33.0
2.0	.45	155.7	11.96	54.2	.054	48.3	.55	-38.1
2.5	.48	140.5	10.24	41.5	.067	46.1	.55	-47.8
3.0	.51	127.6	8.65	28.7	.077	35.4	.51	-57.1
3.5	.52	115.8	7.36	18.1	.087	34.1	.50	-64.8
4.0	.55	105.0	6.33	7.7	.099	29.6	.49	-76.1
4.5	.56	96.4	5.35	-3.7	.110	26.5	.49	-85.5
5.0	.58	88.2	4.58	-15.5	.123	19.5	.50	-99.0
5.5	.60	79.2	3.69	-26.5	.140	14.4	.48	-111.9
6.0	.62	70.9	3.10	-35.4	.152	7.8	.49	-124.9

AT-60570
.1-6 GHz Low Noise Silicon Bipolar Transistor Summary Data

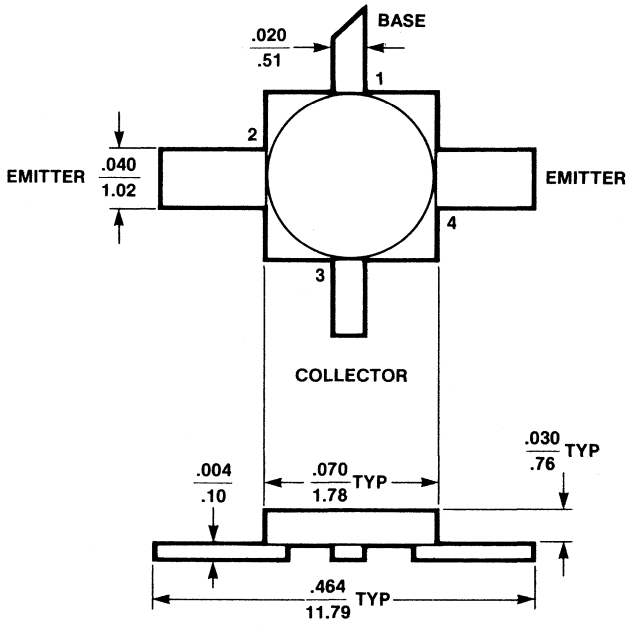
FEATURES

- **Low Current Operation**
- **1.6 dB NF_O @ 2 GHz**
- **12 dB G_A @ 2 GHz**
- **12 dB $|S_{21}|^2$ @ 2 GHz**
- **Hermetic Stripline Package**

DESCRIPTION

The AT-60570 is a low noise, high gain, low current silicon bipolar transistor using nitride self-alignment and ion implantation for precise control of emitter and base doping. The transistor chip is metalized with one micrometer thick gold and passivated with silicon nitride. This transistor is packaged in the high performance 70 mil stripline, a hermetic, high reliability ceramic package using gold plated leads.

Avantek 70 mil Stripline Package



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure, V_{CE} = 8V, I_C = 2.0 mA	1.0 GHz 2.0 GHz 4.0 GHz	dB		1.3 1.6 2.8	 2.1
G_A	Associated Gain at NF_O	1.0 GHz 2.0 GHz 4.0 GHz	dB	 11.0	16.0 12.0 8.0	
$\|S_{21}\|^2$	Insertion Power Gain, V_{CE}=8.0V, I_C=15 mA	2.0 GHz 4.0 GHz	dB		12.0 6.0	
MAG	Maximum Available Gain, V_{CE}=8.0V, I_C=15.0 mA	4.0 GHz	dB		11.0	
h_{FE}	Forward Current Transfer Ratio V_{CE} = 8.0V, I_C = 4.0 mA			30	150	300
I_{CBO}	Collector Cutoff Current, V_{CB} = 8.0V		uA			0.2
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			2.0
C_{CB}	Collector Base Capacitance, V_{CB} = 8.0V	1.0 MHz	pF		.14	

RECOMMENDED MAXIMUM RATINGS

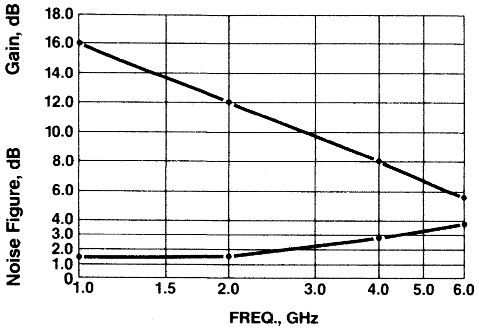
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.0V	1.5V
Collector-Base Voltage	V_{CBO}	16V	20V
Collector-Emitter Volt.	V_{CEO}	10V	12V
Collector Current	I_C	20 mA	40 mA
Continuous Dissipation[3]	P_T	200 mW	400 mW
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 300°C/W

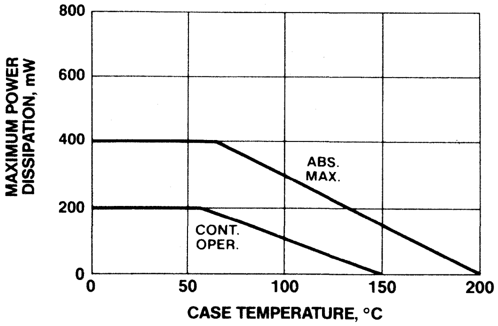
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} 25°C.

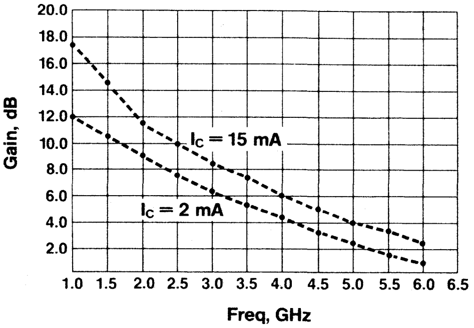
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY
$V_{CE} = 8V, I_C = 2$ mA



MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



MAXIMUM AVAILABLE GAIN (MAG) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. COLLECTOR CURRENT
FREQ. = 1.0 GHz - V_{CE} = 8V



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

$V_{CE} = 8V, I_C = 2$ mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.77	-83.2	12.16	112.5	.071	38.8	.83	-34.6
1.5	.69	-115.3	10.57	91.1	.082	24.4	.75	-47.1
2.0	.63	-140.9	8.90	72.3	.086	14.1	.70	-54.2
2.5	.59	-161.1	7.74	57.1	.093	5.3	.69	-63.9
3.0	.57	-179.3	6.36	41.3	.093	-.4	.67	-72.9
3.5	.56	165.3	5.29	29.5	.092	-3.5	.67	-80.0
4.0	.55	150.1	4.25	17.0	.092	-7.9	.67	-90.3
4.5	.54	138.3	3.29	4.9	.092	-10.0	.67	-97.2
5.0	.55	126.2	2.35	-6.6	.102	-16.5	.69	-105.4
5.5	.55	114.5	1.52	-18.5	.100	-16.4	.70	-114.7
6.0	.56	103.8	.84	-27.2	.102	-18.4	.72	-123.0

$V_{CE} = 8V, I_C = 15$ mA

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
1.0	.54	-163.2	17.43	83.3	.030	41.3	.59	-32.1
1.5	.54	177.5	14.26	68.0	.037	42.4	.57	-41.1
2.0	.54	162.6	11.73	54.4	.044	42.6	.56	-47.8
2.5	.55	151.4	10.07	42.6	.052	36.2	.57	-57.8
3.0	.55	140.2	8.39	30.3	.061	33.5	.57	-67.3
3.5	.55	129.2	7.13	20.2	.069	32.0	.59	-75.2
4.0	.56	118.5	5.95	9.5	.078	27.8	.60	-86.0
4.5	.55	109.8	4.86	-1.7	.087	25.0	.60	-93.4
5.0	.57	100.7	3.95	-11.9	.097	13.5	.63	-102.2
5.5	.57	91.5	2.98	-22.8	.105	13.2	.64	-111.6
6.0	.58	83.0	2.31	-30.9	.115	8.2	.66	-120.3

AT-64020
.1-4 GHz Linear Power Silicon Bipolar Transistor Summary Data

FEATURES

- At 2 GHz, Typical
    - Sat. Output Power = 29 dBm
    - P_{1dB} =+28 dBm
    - Associated Gain = 10 dB
- Emitter Ballast Resistor
- Gold Metal System
- 3.0 W Maximum P_T
- Hermetic Beryllia/Metal Stripline Package

DESCRIPTION

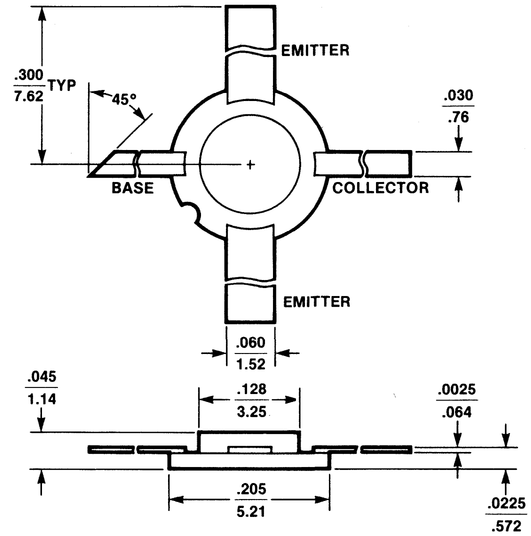
The AT-64020 transistor is a high power, high gain amplifier for applications through 4 GHz. It uses an advanced gold metal system that produces an extremely uniform conductor more than 1μm thick with excellent step coverage.

This metal system prevents performance degradation or failure from excessive contact heating, excessive current density or metal migration under high power, high temperature operation.

A multi-emitter geometry is used with the current distribution through the emitter fingers controlled by ion implanted ballast resistors. Unlike deposited metal resistors, the junction characteristics of the ion implanted resistors serves to self-limit the emitter current by providing a finite number of charge carriers. In addition, the inherently well-matched resistance of ion implanted resistors assures unit-to-unit uniformity and batch reproducability.

The AT-64020 is packaged in a metal/beryllia micro-strip package specifically designed for low thermal resistance. To assure long term reliability of the AT-64020 under severe environmental conditions the package is filled with a dry, inert atmosphere, hermetically sealed and leak tested.

Avantek 200 mil Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions (V_{CE} = 16.0V, I_C = 110 mA)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz 4.0 GHz	dBm	27.0	28.0 27.0	
$G_{1\,dB}$	1 dB Compressed Gain	2.0 GHz 4.0 GHz	dB	9.0	10.0 8.0	
$P_{3\,dB}$	Power Output at 3 dB Gain Compression	2.0 GHz	dBm		29.0	
$\vert S_{21}\vert^2$	Insertion Power Gain	1.0 GHz 2.0 GHz	dB		12.0 6.0	
MAG	Maximum Available Gain	2.0 GHz	dB		12.0	
h_{FE}	Forward Current Transfer Ratio V_{CE} = 8.0 V, I_C = 110 mA			20	50	200
I_{CBO}	Collector Cutoff Current, V_{CB} = 16V		uA			100
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			5.0

RECOMMENDED MAXIMUM RATINGS

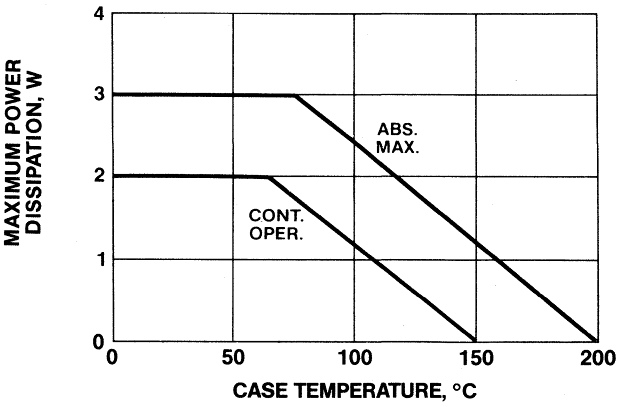
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.5V	2.0V
Collector-Base Voltage	V_{CBO}	32V	40V
Collector Emitter Volt.	V_{CEO}	16V	20V
Collector Current	I_C	125 mA	200 mA
Continuous Dissipation[3]	P_T	2.0 W	3.0 W
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 50°C/W

Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{CE}=10V, I_C=50 mA

Freq. GHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.5	.75	-178.2	17.84	85.3	.031	41.5	.23	-76.5
1.0	.76	161.5	11.98	63.0	.046	48.3	.19	-93.1
1.5	.77	148.5	8.64	45.8	.065	49.0	.21	-111.4
2.0	.79	136.5	6.03	28.6	.081	42.7	.24	-130.2
2.5	.80	124.3	4.20	12.9	.101	39.3	.29	-145.3
3.0	.80	113.8	2.41	-1.9	.124	31.1	.34	-159.7
3.5	.81	102.9	1.04	-14.7	.148	27.8	.40	-171.1
4.0	.82	92.3	-.17	-27.6	.170	18.7	.46	176.5

V_{CE}=16V, I_C=110 mA

Freq. GHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
0.1	.58	-116.7	29.44	131.2	.020	48.8	.68	-51.8
0.5	.74	-175.6	18.20	86.1	.034	37.8	.24	-99.7
1.0	.76	167.1	12.36	64.9	.048	44.7	.19	-118.7
1.5	.76	152.5	9.03	48.8	.065	46.6	.21	-130.8
2.0	.77	141.4	6.58	34.5	.085	45.2	.24	-142.0
2.5	.78	130.3	4.69	20.7	.105	39.7	.28	-149.7
3.0	.78	119.8	3.27	5.6	.128	34.0	.33	-158.8
3.5	.79	108.0	1.91	-7.7	.152	28.0	.37	-169.1
4.0	.79	98.6	.89	-19.8	.176	21.7	.42	178.9

AT-64023
.1-4 GHz Linear Power Silicon Bipolar Transistor Summary Data

FEATURES

- **At 4 GHz, Typical**
  - **Sat. Output Power = +29 dBm**
  - **P_{1dB} = +27.5 dBm**
  - **Associated Gain = 10.5 dB**
- **Emitter Ballast Resistor**
- **Gold Metal System**
- **3.0 W Maximum P_T**
- **Hermetic Beryllia/Metal Stripline Package**

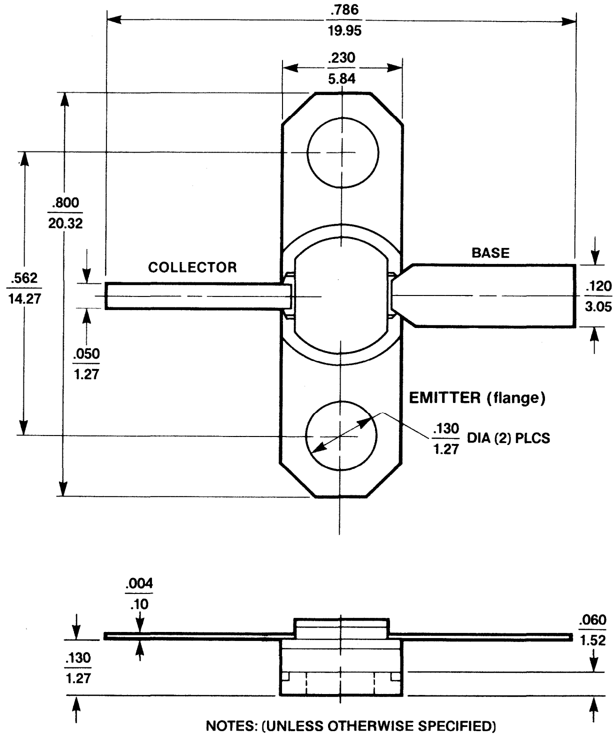
DESCRIPTION

The AT-64023 transistor is a high power, high gain amplifier for applications through 4 GHz. It uses an advanced gold metal system that produces an extremely uniform conductor more than $1 \mu m$ thick with excellent step coverage. This metal system prevents performance degradation or failure from excessive contact heating, excessive current density or metal migration under high power, high temperature operation.

A multi-emitter geometry is used with the current distribution through the emitter fingers controlled by ion implanted ballast resistors. Unlike deposited metal resistors, the junction characteristics of the ion implanted resistors serves to self-limit the emitter current by providing a finite number of charge carriers. In addition, the inherently well-matched resistance of ion implanted resistors assures unit-to-unit uniformity and batch reproducability.

The AT-64023 is packaged in a metal/beryllia micro-strip package specifically designed for low thermal resistance and equipped with a highly conductive copper mounting flange for maximum transfer of heat to radiator or circuit board. To assure long term reliability of the AT-64023 under severe environmental conditions the package is filled with a dry, inert atmosphere, hermetically sealed and leak tested.

Avantek 230 mil Flange Package



NOTES: (UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN $\frac{IN}{MM}$
2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions (V_{CE} = 16.0V, I_C = 110 mA)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Power Output at 1 dB Gain Compression	2.0 GHz 4.0 GHz	dBm	 25.5	28.0 27.5	
$G_{1\,dB}$	1 dB Compressed Gain	2.0 GHz 4.0 GHz	dB	 7.0	11.5 10.5	
$P_{3\,dB}$	Power Output at 3 dB Gain Compression	4.0 GHz	dBm		29.0	
$\lvert S_{21} \rvert^2$	Insertion Power Gain	1.0 GHz 2.0 GHz	dB		12.0 6.5	
MAG	Maximum Available Gain	2.0 GHz	dB		14.0	
h_{FE}	Forward Current Transfer Ratio V_{CE} = 8.0 V, I_C = 110 mA			20	50	200
I_{CBO}	Collector Cutoff Current, V_{CB} = 16V		uA			100
I_{EBO}	Emitter Cutoff Current, V_{EB} = 1.0V		uA			5.0

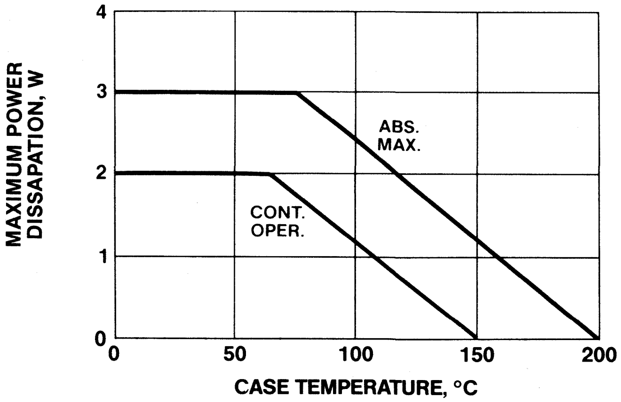
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Emitter-Base Voltage	V_{EBO}	1.5V	2.0V
Collector-Base Voltage	V_{CBO}	32V	40V
Collector Emitter Volt.	V_{CEO}	16V	20V
Collector Current	I_C	125 mA	200 mA
Continuous Dissipation[3]	P_T	2.0 W	3.0 W
Junction Temperature	T_j	150°C	200°C
Storage Temperature	T_{STG}	— 65°C to 150°C	200°C

Thermal Resistance, θ_{jc}: 50°C/W

Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

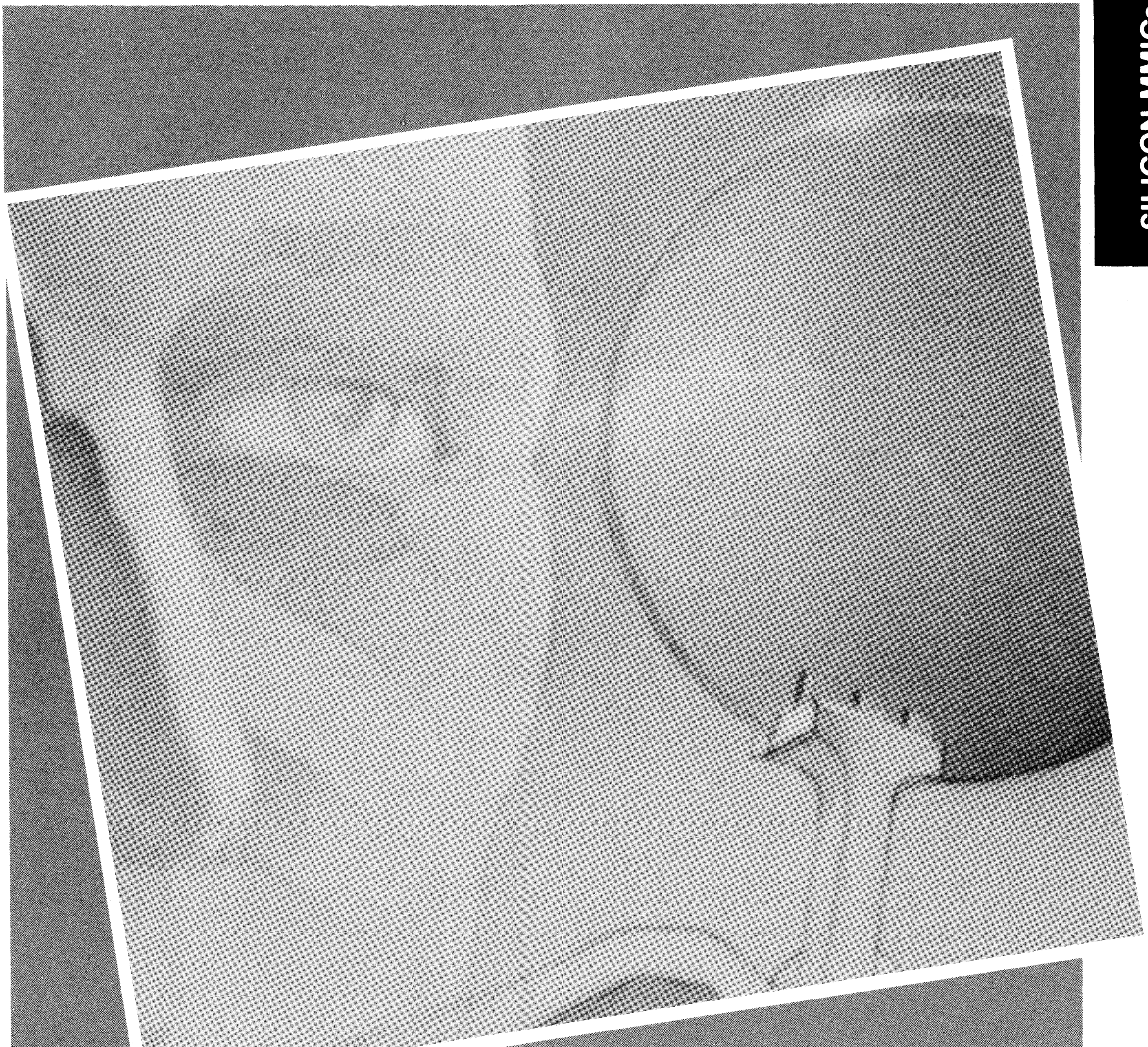
V_{CE} = 10V, I_C = 50 mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.5	.81	-170.6	17.39	80.8	.035	14.0	.32	-112.7
1.0	.82	174.4	11.61	55.0	.036	10.7	.34	-129.6
1.5	.83	163.7	8.34	33.8	.037	12.0	.41	-141.8
2.0	.81	155.6	5.95	14.2	.040	13.2	.50	-153.9
2.5	.80	148.5	4.29	-5.8	.043	11.4	.59	-164.2
3.0	.77	141.5	2.95	-26.6	.046	6.9	.68	-174.1
3.5	.71	134.5	1.96	-47.2	.048	- .1	.78	-176.2
4.0	.64	130.6	1.40	-69.3	.046	-9.6	.90	167.5

V_{CE} = 16V, I_C = 110 mA

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
0.5	.81	-172.5	17.92	80.4	.032	16.1	.30	-120.6
1.0	.82	173.4	12.12	55.4	.034	15.6	.32	-135.3
1.5	.82	162.7	8.88	34.5	.037	16.9	.39	-145.2
2.0	.81	154.8	6.60	15.1	.041	17.1	.47	-155.3
2.5	.79	147.9	5.00	-.53	.045	13.7	.56	-164.3
3.0	.75	141.1	3.70	-26.5	.049	7.7	.66	-173.4
3.5	.70	134.4	2.71	-47.8	.050	-.4	.76	177.1
4.0	.62	131.2	2.10	-70.6	.047	-10.3	.89	168.3

MODAMP™ Silicon MMIC Amplifiers



INTRODUCTION
MODAMP™ MONOLITHIC MICROWAVE INTEGRATED CIRCUITS (MMICs)

The MSA series of monolithic silicon amplifiers is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMICs) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability. They use series and shunt feedback and exhibit very high uniformity fron amplifier to amplifier. Typical applications include narrow and broadband IF and RF amplifiers in military anc commercial mobile, airborne and land based systems

Guaranteed Performance: MODAMP™ MONOLITHIC MICROWAVE INTEGRATED CIRCUITS (MMICs)

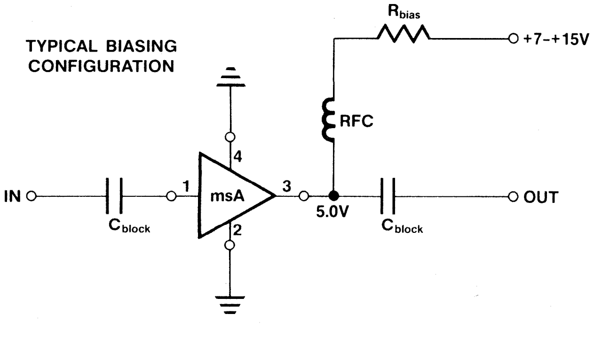
Part Number[2]	Maximum Useable Frequency (GHz)	Typical Gain @0.1 Ghz (dB)	Minimum f_{1dB} (GHz)	Noise Figure[1] Typical (dB)	P_{1dB}[1] Typical (dBm)	Typical Third Order IP[1], (dBm)	Package
MSA-0135-12	1.5	18.5	0.25	5	1.0	14.5	micro-X
MSA-0170-12	1.5	18.5	0.3	5	1.0	14.5	70 mil
MSA-0135-11	2	18.5	0.4	5	1.0	14.5	micro-X
MSA-0170-11	2	18.5	0.5	5	1.0	14.5	70 mil
MSA-0135-22	2.5	19.0	0.3	5	1.5	15	micro-X
MSA-0170-22	2.5	19.0	0.4	5	1.5	15	70 mil
MSA-0135-21	3	19	0.5	5	1.5	15	micro-X
MSA-0170-21	3	19	0.6	5	1.5	15	70 mil
MSA-0235-12	1.5	11.5	0.8	6	3.0	16	micro-X
MSA-0270-12	1.5	11.5	1.0	6	3.0	16	70 mil
MSA-0235-11	2	11.5	1.0	6	3.0	16	micro-X
MSA-0270-11	2	11.5	1.3	6	3.0	16	70 mil
MSA-0235-22	2.5	12.5	1.3	6	4.0	17	micro-X
MSA-0270-22	2.5	12.5	1.4	6	4.0	17	70 mil
MSA-0235-21	3	12.5	1.6	6	4.0	17	micro-X
MSA-0270-21	3	12.5	1.8	6	4.0	17	70 mil
MSA-0335-12	1.5	11.5	0.8	6	9.0	22	micro-X
MSA-0370-12	1.5	11.5	1.0	6	9.0	22	70 mil
MSA-0335-11	2	11.5	1.0	6	9.0	22	micro-X
MSA-0370-11	2	11.5	1.3	6	9.0	22	70 mil
MSA-0335-22	2.5	12.5	1.3	6	10	23	micro-X
MSA-0370-22	2.5	12.5	1.4	6	10	23	70 mil
MSA-0335-21	3	12.5	1.6	6	10	23	micro-X
MSA-0370-21	3	12.5	1.8	6	10	23	70 mil
MSA-0435[3]	3	8.5	2.0	6	13	28	micro-X
MSA-0470[3]	3	8.5	2.0	6	13	28	70 mil
MSA-0420[3]	2.5	9.0	2.0	6	19	34	200 mil

Notes 1: Test frequency is 500 MHz.

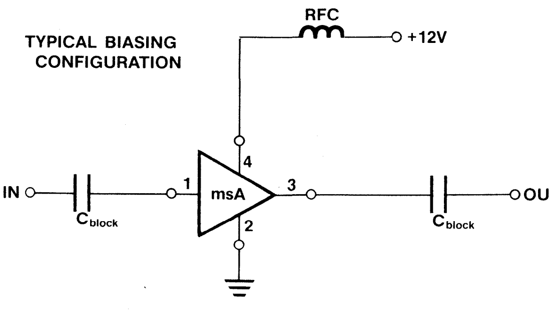
2: Model: -21 Double Ground – requires an external bias choke or resistor at the output – has the highest bandwidth.
-22 Same as -21 except has lower guaranteed f_{1dB}.
-11 Single ground – requires +12 volt bias on lead 4.
-12 Same as -11 except has lower guaranteed f_{1dB}.

Typical installation schematics:

SCHEMATIC I
DUAL GROUND
MODELS = –21, –22

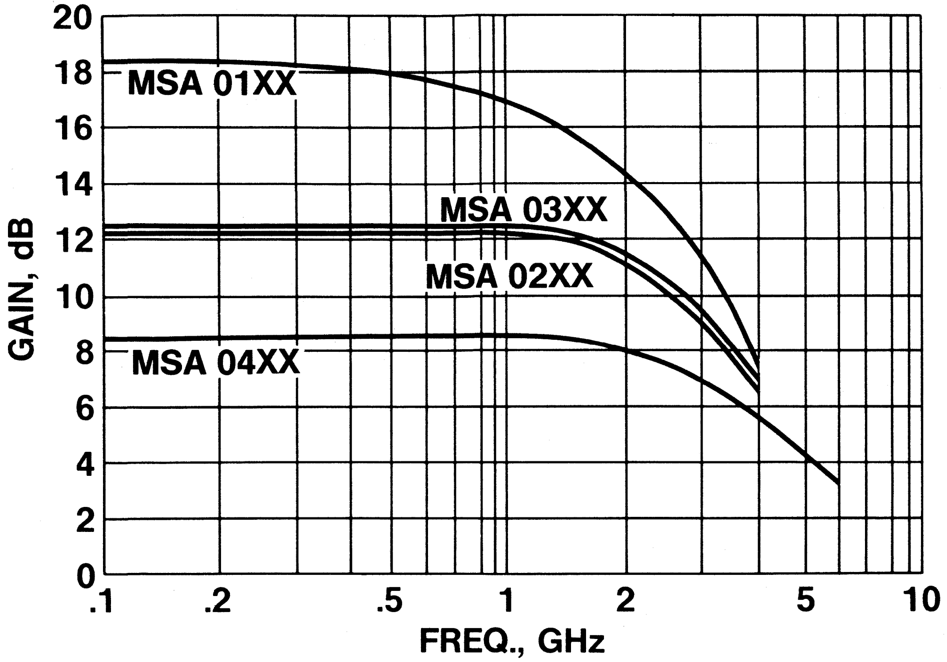


SCHEMATIC II
SINGLE GROUND
MODELS = –11, –12

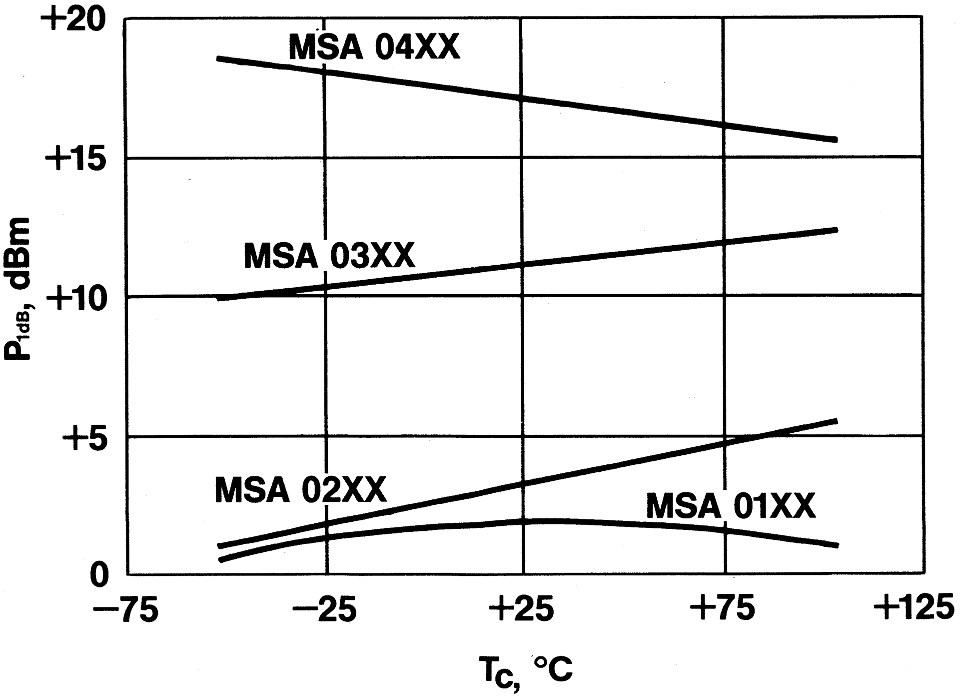


3: Model -21 only.

TYPICAL GAIN vs. FREQUENCY



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. JUNCTION TEMPERATURE F_O = 500 MHz, I_C = TYPICAL VALUE



MSA-0135-1X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

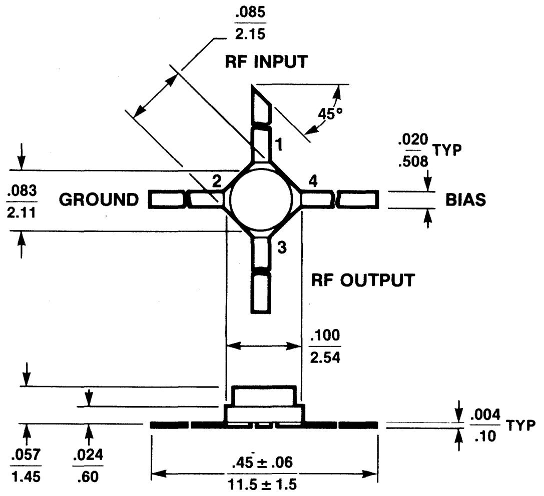
- **Narrow or Broadband Operation up to 2 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **19 dB gain @ 200 MHz**
- **+12V bias (No external bias resistor required)**
- **+1.5 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

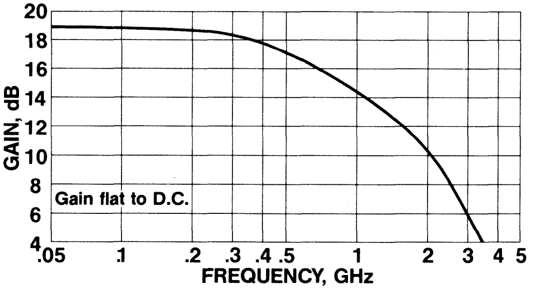
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

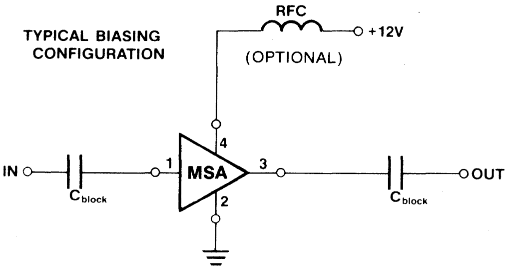
Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C, I = 17$ mA



TYPICAL BIASING CONFIGURATION



ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	-11	12.0	17.0	0.1	dB	17.5	18.5	19.5
		-12					17.5	18.5	19.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	17.0	—	GHz	0.40		
		-12					0.25		
f_{SWR} (IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	17.0	—	GHz		4	
f_{SWR} (OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	17.0	—	GHz		5	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	17.0	0.5	dBm		1	
NF_{50}	50Ω Noise Figure		12.0	17.0	0.5	dB		5	
IP_3	Third Order Intercept Point		12.0	17.0	0.5	dBm		14.5	
HP_2	Second Harmonic Intercept Point		12.0	17.0	0.5	dBm		30	
t_D	Group Delay		12.0	17.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	20 mA	40 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

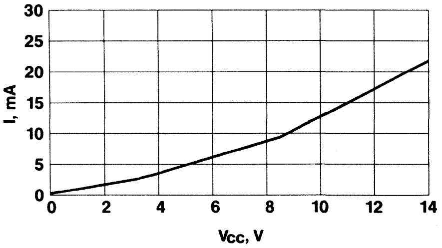
Thermal Resistance, θ_{jc}: 170° C/W

Notes:

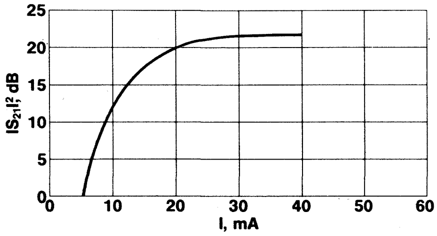
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above + 150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, T_A=25° C

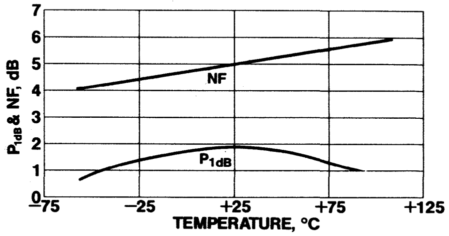
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



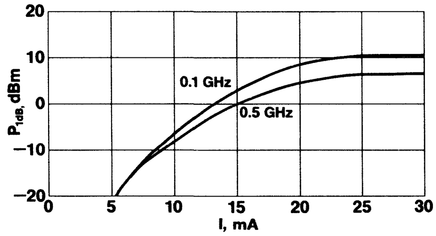
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



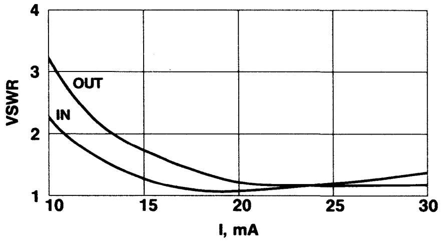
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=17 mA, FREQ.=.5 GHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = .5 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0135-11

I = 17 mA (V = 12.0V Typ.)

Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.09	134.7	18.87	169.1	.069	4.9	.03	94.8
200	.12	105.4	18.59	158.8	.071	9.3	.05	75.7
400	.17	69.7	17.90	139.7	.078	16.2	.10	56.8
500	.19	55.5	17.30	131.0	.082	18.7	.11	48.9
750	.19	31.5	15.70	110.2	.099	4.2	.12	33.3
1000	.21	-1.1	14.40	97.4	.120	7.9	.14	20.1
1500	.21	-16.8	12.19	73.5	.133	23.2	.14	8.6
2000	.16	-47.9	10.51	52.4	.158	18.6	.11	-4.1
2500	.10	-91.3	8.77	33.0	.180	11.7	.07	-18.2
3000	.10	-152.1	7.31	14.8	.195	5.1	.03	-54.4
3500	.15	169.6	5.73	-2.2	.202	-1.8	.06	165.7
4000	.26	134.8	4.63	-12.1	.226	-2.2	.09	119.1

MSA-0135-12

Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.07	125.3	18.73	169.5	.067	5.0	.03	119.8
200	.10	96.5	18.46	159.7	.069	9.5	.04	91.1
400	.16	64.7	17.60	141.5	.075	16.2	.06	64.5
500	.19	51.3	17.05	133.2	.079	18.8	.07	54.5
750	.25	27.3	15.80	106.1	.072	16.0	.07	38.4
1000	.24	13.4	14.60	98.7	.101	17.7	.07	16.5
1250	.24	-3.0	13.44	86.8	.116	24.1	.08	10.4
1500	.23	-14.8	12.38	74.5	.129	22.6	.08	1.4
1750	.20	-29.6	11.41	63.1	.141	20.0	.06	-10.8
2000	.17	-44.3	10.48	52.7	.152	17.0	.05	-23.5
2500	.11	-79.3	8.70	33.4	.171	10.1	.02	-83.4
3000	.09	-137.6	7.12	16.2	.185	3.4	.05	-173.3
3500	.14	176.1	5.57	.4	.192	-3.6	.12	157.6
4000	.25	139.2	4.15	-8.6	.206	-3.6	.17	120.5

MSA-0135-2X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

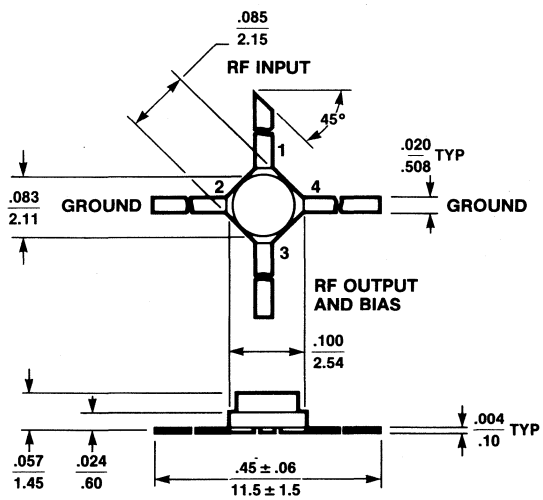
- **Fully Cascadable (VSWR <2:1)**
- **19 dB gain @ 300 MHz**
- **+5V bias (Note R_{bias} required)**
- **+1.5 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

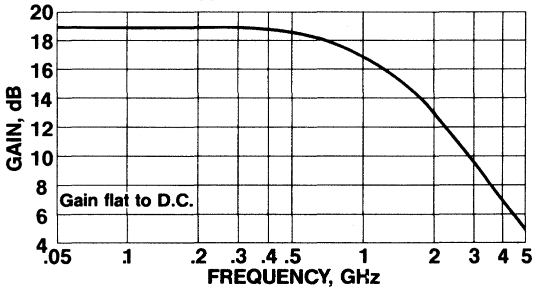
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

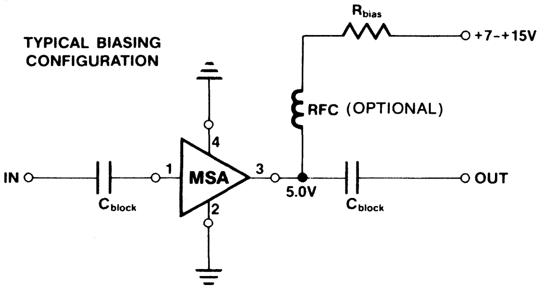
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C, I = 17$ mA





ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	-21	5.0	17.0	0.1	dB	18.0	19.0	20.0
		-22					18.0	19.0	20.0
f_{1dB}	Frequency at -1dB Gain Point[1]	-21	5.0	17.0	—	GHz	0.5		
		-22					0.3		
f_{SWR} (IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	17.0	—	GHz		4	
f_{SWR} (OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	17.0	—	GHz		5	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	17.0	0.5	dBm		1.5	
NF_{50}	50Ω Noise Figure		5.0	17.0	0.5	dB		5	
IP_3	Third Order Intercept Point		5.0	17.0	0.5	dBm		15	
HP_2	Second Harmonic Intercept Point		5.0	17.0	0.5	dBm		31.0	
t_D	Group Delay		5.0	17.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	20 mA	40 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

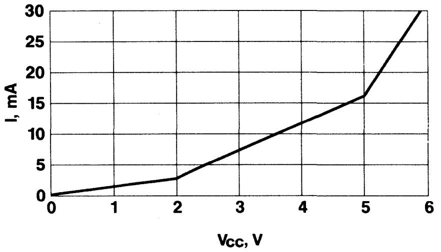
Thermal Resistance, θ_{jc}: 90° C/W

Notes:

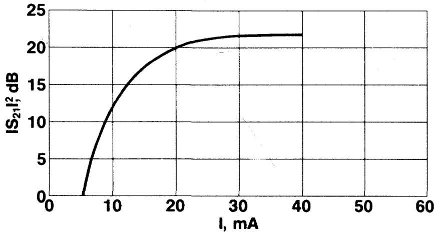
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above + 150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, $T_A = 25° C$

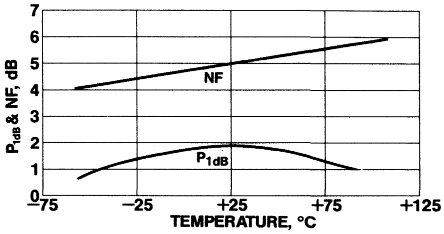
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



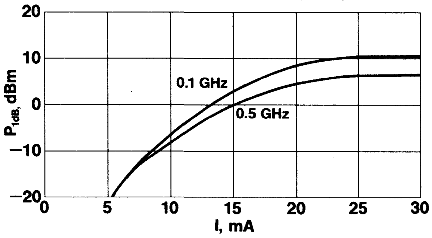
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



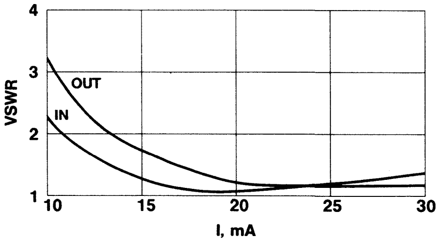
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=17 mA, FREQ.=.5 GHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = .5 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0135-21 I = 17 mA (V = 5.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.04	164.0	19.0	174.0	.073	5.0	.10	-6.0
200	.04	146.0	18.9	170.0	.074	9.0	.10	-14.0
400	.03	113.0	18.5	156.0	.077	16.0	.10	- 29.0
600	.03	71.0	18.0	146.0	.081	23.0	.08	-44.0
800	.03	29.0	17.5	138.0	.088	29.0	.07	-58.0
1000	.04	-11.0	16.8	127.0	.094	33.0	.06	-71.0
1200	.06	-38.0	16.1	120.0	.102	37.0	.05	-84.0
1400	.07	-63.0	15.4	112.0	.111	40.0	.04	-101.0
1600	.09	-80.0	14.6	106.0	.116	41.0	.03	-116.0
1800	.11	-95.0	13.9	101.0	.126	43.0	.03	-123.0
2000	.14	-107.0	13.2	95.0	.132	46.0	.03	-138.0
3000	.25	-143.0	9.9	75.0	.157	48.0	.01	-129.0
4000	.35	-162.0	7.2	61.0	.175	52.0	.06	-63.0

MSA-0135-22

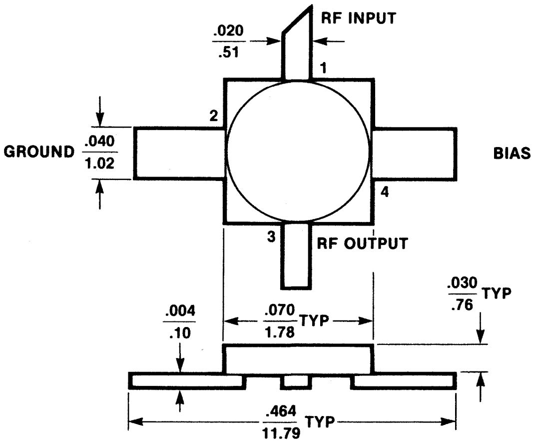
Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.13	166.2	19.62	172.1	.070	3.3	.02	177.4
200	.13	155.2	19.48	164.4	.071	6.2	.02	-179.0
400	.11	133.7	18.98	149.5	.074	11.6	.02	179.8
500	.10	117.5	18.63	142.4	.077	13.9	.03	177.0
750	.09	55.6	17.97	116.8	.082	15.3	.03	178.0
1000	.07	36.4	16.91	109.4	.091	17.4	.03	168.7
1250	.04	9.8	16.12	97.3	.105	20.4	.04	133.2
1500	.03	-54.7	15.18	84.7	.115	19.2	.05	120.2
1750	.05	-108.6	14.28	72.9	.125	16.9	.05	106.8
2000	.08	-138.5	13.32	62.2	.134	14.3	.05	94.9
2500	.14	-172.1	11.49	43.5	.147	8.5	.04	73.0
3000	.20	165.9	9.84	28.1	.158	3.2	.03	48.8
3500	.26	147.2	8.62	13.7	.167	-2.0	.01	-15.3
4000	.31	130.9	7.32	-.2	.175	-8.4	.03	-118.6

MSA-0170-1X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

- **Narrow or Broadband Operation up to 2 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **19 dB gain @ 300 MHz**
- **+12V bias (No external bias resistor required)**
- **+1.5 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

Avantek 70 mil Package

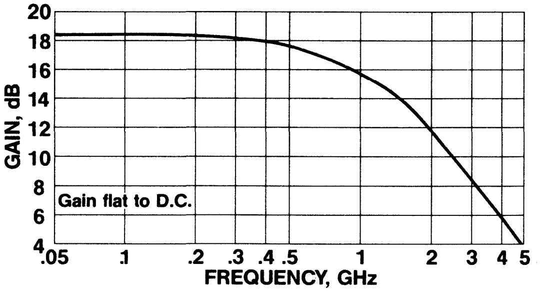


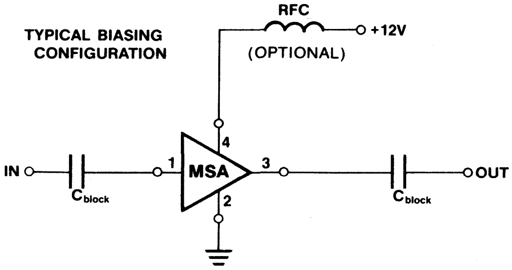
DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

TYPICAL GAIN vs. FREQUENCY
T_A = 25°C, I = 17 mA





ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\vert S_{21}\vert^2$	Insertion Power Gain	-11	12.0	17.0	0.1	dB	17.5	18.5	19.5
		-12					17.5	18.5	19.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	17.0	—	GHz	0.5		
		-12					0.3		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	17.0	—	GHz		4	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	17.0	—	GHz		5	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	17.0	0.5	dBm		1	
NF_{50}	50Ω Noise Figure		12.0	17.0	0.5	dB		5	
IP_3	Third Order Intercept Point		12.0	17.0	0.5	dBm		14.5	
HP_2	Second Harmonic Intercept Point		12.0	17.0	0.5	dBm		30	
t_D	Group Delay		12.0	17.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.
Note 2: An internal 45pF (Opt. C45) input blocking capacitor is available ($@S_{21}@^2$ is tested @ 200 MHz)

RECOMMENDED MAXIMUM RATINGS

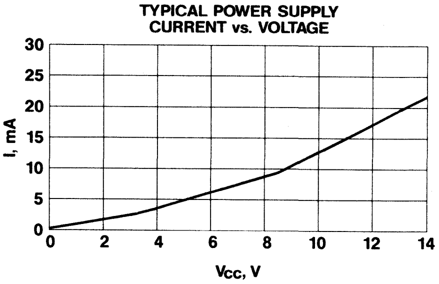
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	20 mA	40 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1x10^6 Hrs.	1x10^4 Hrs.

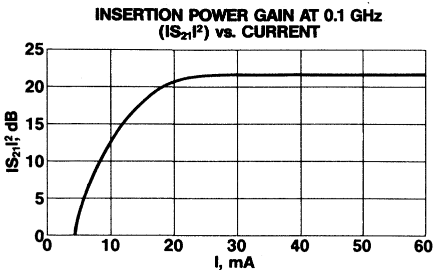
Thermal Resistance, θ_{jC}: 160° C/W

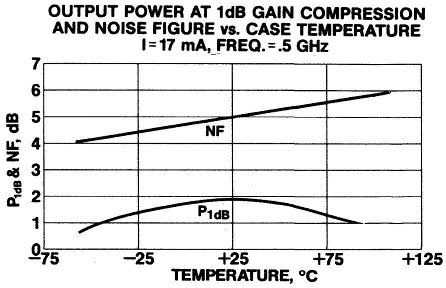
Notes:

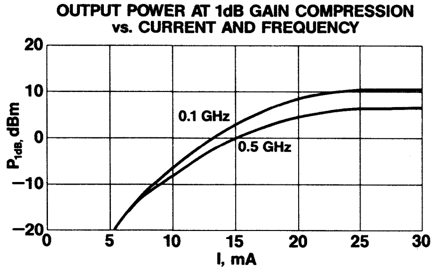
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

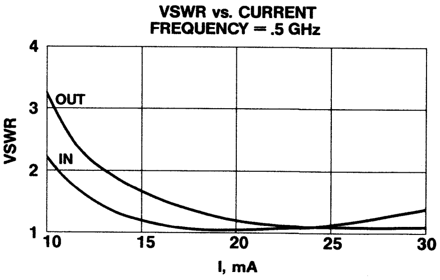
TYPICAL PERFORMANCE, T_A=25° C


TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE


INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT


OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE
I=17 mA, FREQ.=.5 GHz


OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY


VSWR vs. CURRENT
FREQUENCY = .5 GHz

TYPICAL SCATTERING PARAMETERS*

MSA-0170-11

I = 17 mA (V = 12.0V Typ.)

Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.02	69.9	18.82	171.6	.068	2.3	.04	-16.0
200	.04	62.8	18.66	163.3	.068	5.3	.05	-38.0
400	.07	41.0	18.18	147.3	.071	10.2	.05	-63.8
500	.08	32.4	17.92	139.6	.073	12.7	.06	-78.5
750	.11	16.7	16.50	119.4	.076	3.3	.05	-99.4
1000	.15	-17.3	15.56	110.6	.135	-1.2	.07	-98.6
1500	.16	-51.6	14.14	79.8	.114	17.5	.09	-127.5
2000	.17	-88.4	12.29	56.7	.133	11.6	.09	-129.4
2500	.19	-120.9	10.47	36.5	.146	3.6	.13	-130.4
3000	.23	-146.7	8.77	17.5	.153	-3.3	.17	-134.9
3500	.28	-170.7	7.00	.8	.155	-7.6	.22	-148.2
4000	.28	162.2	5.16	-11.5	.185	-12.3	.23	-160.1

MSA-0170-12

Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.06	149.7	18.54	171.4	.069	3.3	.03	-178.5
200	.07	125.1	18.37	163.2	.069	6.4	.03	-170.9
400	.08	86.8	17.78	147.5	.072	11.8	.03	-159.2
500	.09	67.2	17.42	140.0	.075	14.3	.03	-156.7
750	.12	34.2	16.52	119.3	.091	15.1	.04	-142.6
1000	.14	14.2	15.56	107.5	.101	16.0	.05	-148.1
1250	.14	-5.6	14.66	94.2	.104	20.8	.05	-151.0
1500	.14	-22.0	13.71	81.4	.114	19.6	.06	-152.5
1750	.14	-41.4	12.77	69.6	.125	17.1	.06	-152.6
2000	.14	-59.6	11.83	58.5	.133	14.5	.07	-152.1
2500	.14	-93.2	9.97	39.5	.147	8.8	.10	-151.7
3000	.16	-125.7	8.40	22.5	.157	5.5	.14	-155.6
3500	.18	-169.6	6.80	7.4	.202	3.0	.18	-175.6
4000	.15	179.0	5.60	-6.4	.211	-14.0	.19	-175.0

MSA-0170-2X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

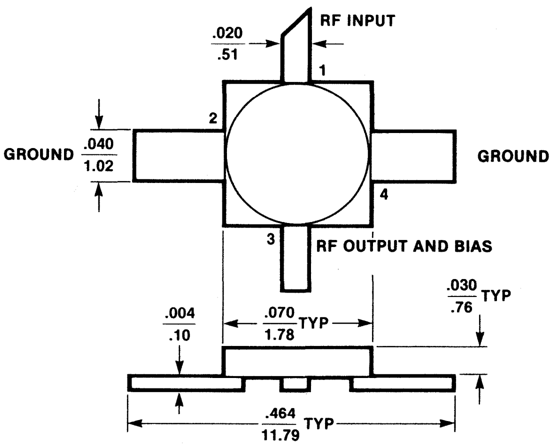
- **Narrow or Broadband Operation to 3 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **+19 dB gain @ 500 MHz**
- **+5.0V bias (Note R_{bias} required)**
- **+1.5 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

DESCRIPTION

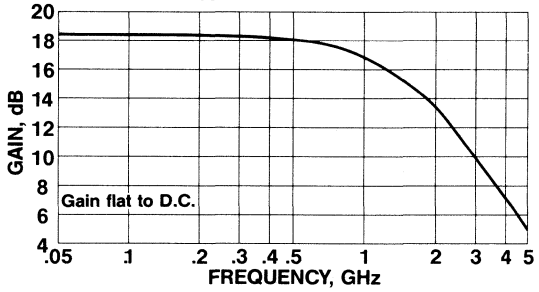
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

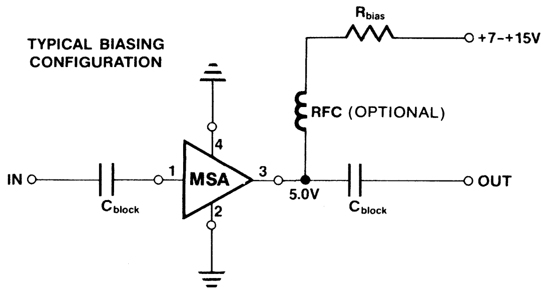
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

Avantek 70 mil Package



TYPICAL GAIN vs. FREQUENCY
T_A = 25°C, I = 17 mA





ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-21	5.0	17.0	0.1	dB	18.0	19.0	20.0
		-22					18.0	19.0	20.0
f_{1dB}	Frequency at -1dB Gain Point[1]	-21	5.0	17.0	—	GHz	0.6		
		-22					0.4		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	17.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	17.0	—	GHz		5.0	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	17.0	0.5	dBm		1.5	
NF_{50}	50Ω Noise Figure		5.0	17.0	0.5	dB		5.0	
IP_3	Third Order Intercept Point		5.0	17.0	0.5	dBm		15.0	
HP_2	Second Harmonic Intercept Point		5.0	17.0	0.5	dBm		31.0	
t_D	Group Delay		5.0	17.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.
Note 2: An internal 45pf (Opt. C45) input blocking capacitor is available ($\lvert S_{21}\rvert^2$ is tested @ 200 MHz.)

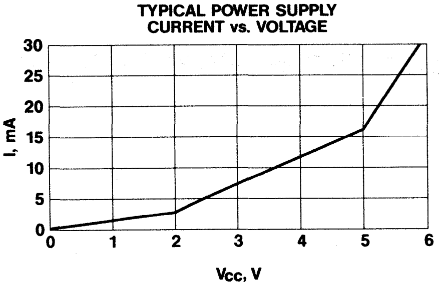
RECOMMENDED MAXIMUM RATINGS

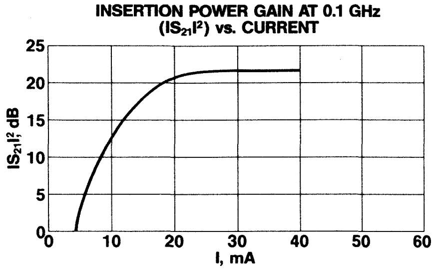
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	20 mA	40 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

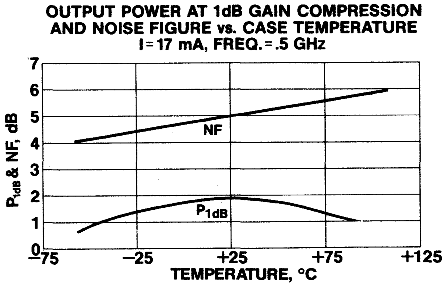
Thermal Resistance, θ_{jc}: 80° C/W

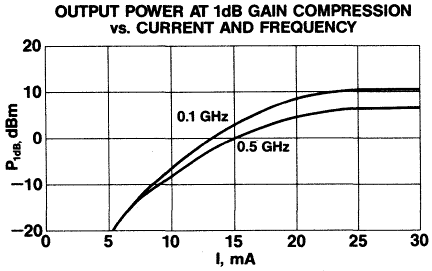
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

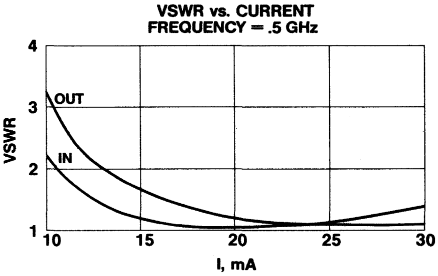
TYPICAL PERFORMANCE, T_A=25° C


TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE


INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT


OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=17 mA, FREQ.=.5 GHz


OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY


VSWR vs. CURRENT FREQUENCY = .5 GHz

TYPICAL SCATTERING PARAMETERS*

MSA-0170-21

I = 17 mA (V = 5.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.02	-8.0	18.50	174.0	.076	3.0	.13	-10.0
200	.01	-17.0	18.50	168.0	.077	5.0	.13	-20.0
400	.01	-33.0	18.20	154.0	.078	9.0	.13	-40.0
600	.01	-50.0	17.90	142.0	.082	12.0	.12	-61.0
800	.04	-66.0	17.50	132.0	.088	16.0	.12	-79.0
1000	.06	-83.0	16.90	119.0	.093	17.0	.11	-97.0
1200	.09	-93.0	16.30	110.0	.101	17.0	.11	-115.0
1400	.12	-105.0	15.70	99.0	.109	18.0	.10	-131.0
1600	.15	-116.0	15.00	90.0	.113	16.0	.10	-146.0
1800	.18	-128.0	14.30	81.0	.122	15.0	.09	-158.0
2000	.20	-139.0	13.60	74.0	.127	15.0	.09	-167.0
3000	.32	-178.0	10.20	40.0	.147	4.0	.09	180.0
4000	.39	157.0	7.20	13.0	.160	-6.0	.08	-165.0

MSA-0170-22

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.07	166.0	19.66	172.6	.069	2.7	.06	-14.7
200	.07	155.8	19.53	165.4	.070	5.1	.06	-30.4
400	.06	135.9	19.11	151.2	.072	9.6	.06	-59.9
500	.04	113.9	18.78	144.4	.074	11.6	.06	-75.0
750	.05	32.3	18.18	120.6	.079	16.6	.07	-110.8
1000	.04	8.6	17.39	113.7	.087	17.5	.08	-124.6
1250	.04	-78.8	16.58	99.3	.100	17.2	.08	-153.6
1500	.06	-113.3	15.75	86.1	.110	15.7	.08	-171.7
1750	.09	-134.4	14.86	73.8	.119	13.1	.08	172.3
2000	.13	-152.3	13.90	62.6	.127	10.0	.08	160.5
2500	.19	179.3	12.08	42.6	.140	2.4	.07	143.2
3000	.26	160.2	10.30	26.4	.149	-3.7	.05	138.0
3500	.32	143.5	8.96	11.3	.157	-10.0	.04	155.4
4000	.36	129.5	7.53	-2.2	.160	-17.1	.05	-173.4

MSA-0235-1X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

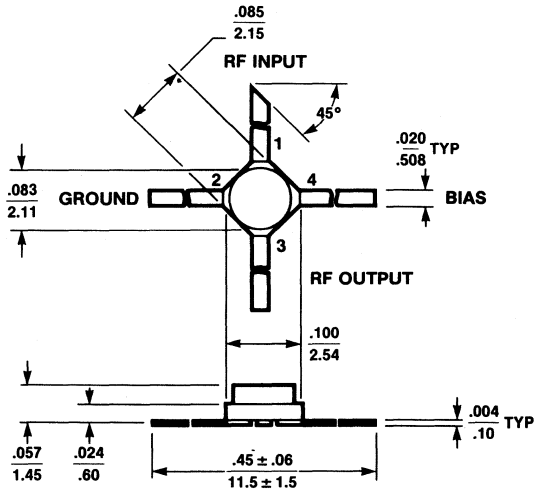
- **Narrow or Broadband Operation to 2 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **11.5 dB gain @ 400 MHz**
- **+12V bias (No external bias required)**
- **+3.0 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

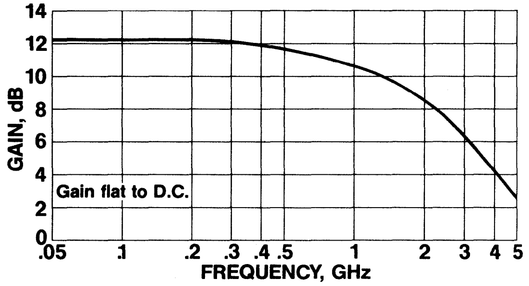
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

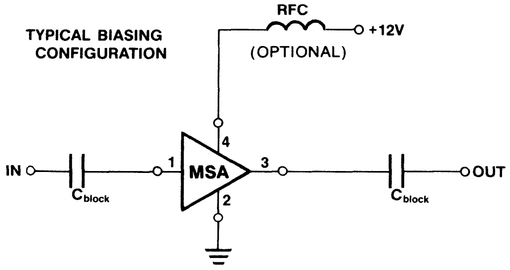
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
T_A = 25°C, I = 25 mA




TYPICAL BIASING CONFIGURATION

ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-11	12.0	25.0	0.1	dB	10.5	11.5	12.5
		-12					10.5	11.5	12.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	25.0	—	GHz	1.0		
		-12					0.8		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	25.0	—	GHz		4	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	25.0	—	GHz		4	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	25.0	0.5	dBm		3.0	
NF_{50}	50Ω Noise Figure		12.0	25.0	0.5	dB		6.0	
IP_3	Third Order Intercept Point		12.0	25.0	0.5	dBm		16.0	
HP_2	Second Harmonic Intercept Point		12.0	25.0	0.5	dBm		31.0	
t_D	Group Delay		12.0	25.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	30 mA	60 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

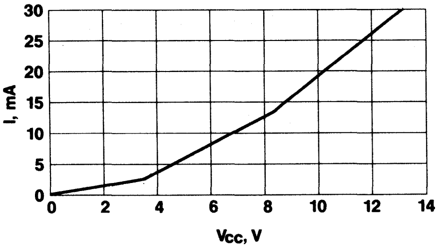
Thermal Resistance, θ_{jc}: 160° C/W

Notes:

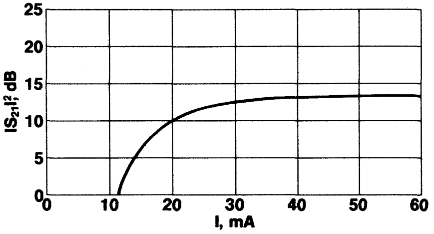
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above + 150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, T_A=25° C

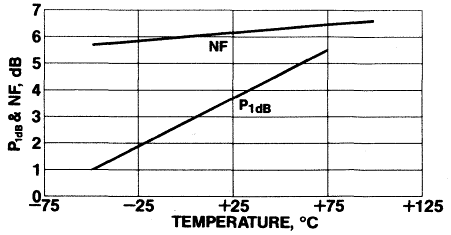
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



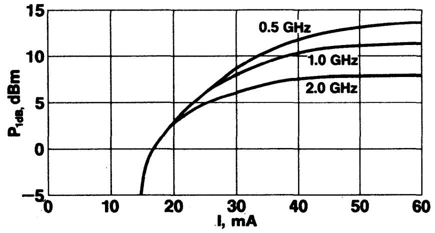
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



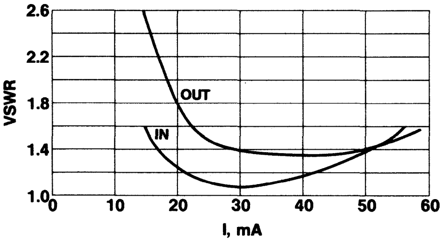
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=25 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0235-11 **I = 25 mA (V = 12.0V Typ.)**

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.02	12.1	12.12	174.9	.103	.9	.11	-12.5
200	.03	8.0	12.06	169.2	.103	1.2	.11	-24.7
400	.03	-5.0	11.94	158.1	.105	2.9	.12	-41.4
500	.04	-11.5	11.89	152.5	.106	3.6	.12	-52.8
750	.05	-23.1	11.70	133.5	.120	-9.4	.10	-72.0
1000	.07	-42.1	11.40	126.5	.164	-10.5	.16	-83.9
1500	.15	-75.5	11.00	98.1	.133	4.7	.16	-119.9
2000	.20	-104.8	10.08	71.6	.147	-.5	.18	-138.8
2500	.25	-129.5	8.65	47.5	.155	-8.1	.21	-151.9
3000	.30	-150.0	7.13	25.1	.156	-13.8	.24	-161.9
3500	.34	-169.6	5.46	6.5	.153	-16.5	.29	-174.7
4000	.33	167.8	3.79	-7.3	.183	-20.8	.30	175.6

MSA-0270-12

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.03	58.1	12.17	173.9	.105	2.5	.14	-4.4
200	.06	60.1	12.13	167.4	.106	4.0	.14	-7.5
400	.10	56.8	11.87	154.4	.109	6.9	.13	-12.6
500	.12	51.2	11.74	148.2	.110	8.6	.13	-15.2
750	.15	35.9	11.34	122.0	.121	9.8	.10	-24.3
1000	.19	24.2	10.72	117.7	.130	12.7	.10	-31.1
1250	.20	18.8	10.39	106.0	.135	14.4	.10	-41.0
1500	.21	9.3	9.88	93.1	.146	14.3	.08	-50.3
1750	.20	-1.5	9.36	80.7	.158	12.9	.07	-66.8
2000	.19	-13.5	8.80	68.9	.168	11.2	.06	-87.5
2500	.14	-36.2	7.61	47.2	.188	6.5	.05	-151.8
3000	.09	-73.0	6.49	27.8	.206	1.4	.09	167.8
3500	.09	-147.3	5.31	9.9	.219	-4.3	.16	145.7
4000	.17	144.7	4.29	-3.7	.248	-7.5	.20	120.1

MSA-0235-2X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

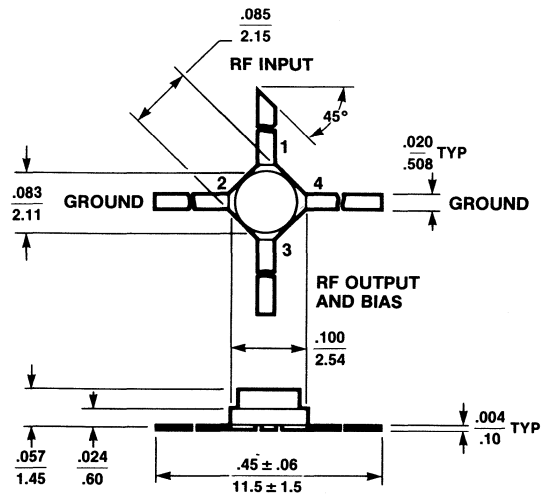
- **Narrow or Broadband Operation to 3 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **12.5 dB gain @ 1.2 GHz**
- **+5V bias (Note R_{bias} required)**
- **+4.0 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

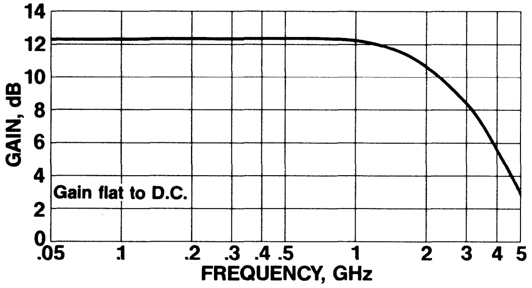
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

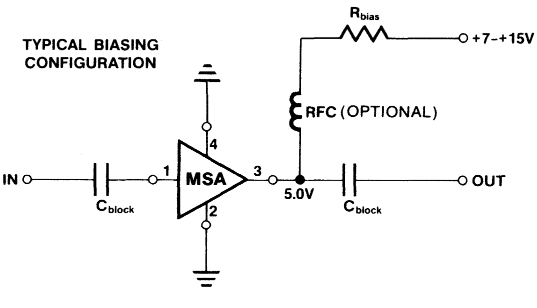
Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C$, I = 25 mA



TYPICAL BIASING CONFIGURATION



ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	-21	5.0	25.0	0.1	dB	11.5	12.5	13.5
		-22					11.5	12.5	13.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-21	5.0	25.0	—	GHz	1.6		
		-22					1.3		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	25.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	25.0	—	GHz		5	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	25.0	0.5	dBm		4.0	
NF_{50}	50Ω Noise Figure		5.0	25.0	0.5	dB		6.0	
IP_3	Third Order Intercept Point		5.0	25.0	0.5	dBm		17	
HP_2	Second Harmonic Intercept Point		5.0	25.0	0.5	dBm		32.0	
t_D	Group Delay		5.0	25.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	30 mA	60 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10^6 Hrs.	1x10^4 Hrs.

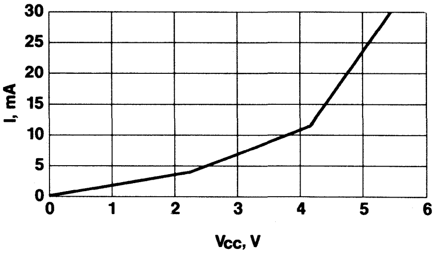
Thermal Resistance, θ_{jc}: 90° C/W

Notes:

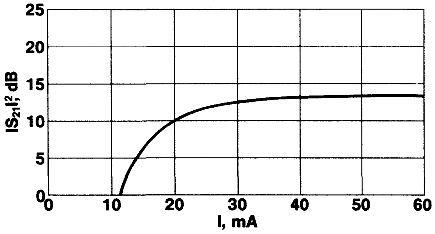
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above + 150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, T_A=25° C

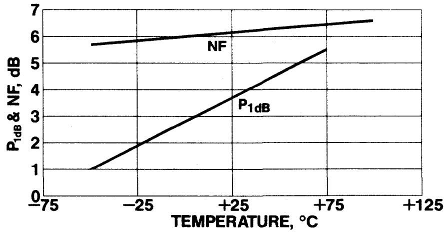
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



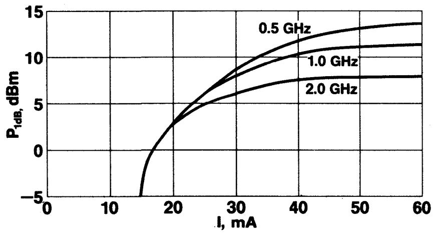
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



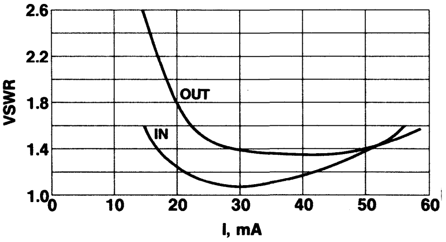
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=25 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0235-21

I = 25 mA (V = 5.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.04	178.0	12.30	176.0	.119	1.0	.20	-4.0
200	.04	172.0	12.30	174.0	.121	4.0	.20	-6.0
400	.03	173.0	12.30	165.0	.118	8.0	.20	-13.0
600	.02	176.0	12.20	158.0	.122	12.0	.19	-19.0
800	.01	-147.0	12.20	153.0	.127	16.0	.18	-25.0
1000	.03	-103.0	12.10	144.0	.126	17.0	.17	-31.0
1200	.04	-93.0	12.00	138.0	.133	22.0	.15	-36.0
1400	.07	-97.0	11.80	130.0	.140	25.0	.14	-43.0
1600	.10	-102.0	11.50	123.0	.140	24.0	.12	-47.0
1800	.13	-111.0	11.20	116.0	.147	28.0	.11	-52.0
2000	.16	-118.0	10.90	109.0	.151	30.0	.10	-55.0
3000	.29	-147.0	8.40	81.0	.159	35.0	.10	-64.0
4000	.40	-162.0	5.30	67.0	.159	46.0	.07	-56.0

MSA-0235-12

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.03	20.6	11.22	175.6	.124	.8	.28	-4.8
200	.04	24.6	11.20	170.6	.124	1.3	.28	-10.0
400	.05	25.4	11.12	160.9	.125	2.5	.28	-17.0
500	.05	24.7	11.07	155.9	.126	3.0	.27	-21.4
750	.07	26.6	11.20	139.1	.127	-1.7	.22	-38.3
1000	.07	19.7	10.80	129.2	.175	-5.8	.28	-41.5
1500	.09	-8.1	10.61	108.7	.150	7.2	.21	-60.4
2000	.08	-40.6	10.16	85.0	.168	4.8	.17	-80.6
2500	.07	-89.9	9.29	62.2	.187	-.4	.14	-101.2
3000	.09	-139.2	8.42	40.8	.200	-6.2	.11	-118.9
3500	.13	-176.0	7.39	21.6	.210	-12.1	.10	-136.3
4000	.18	157.3	6.24	3.8	.219	-18.9	.10	-145.8

MSA-0270-1X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

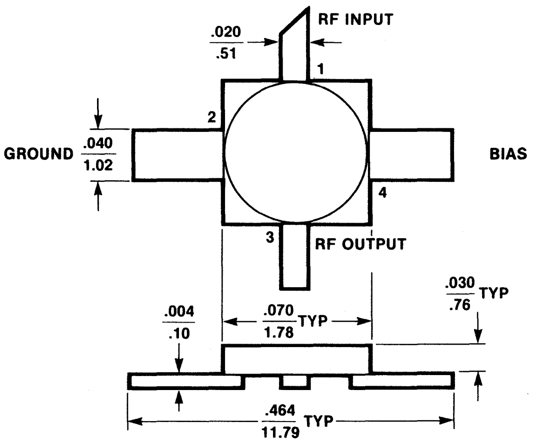
- **Narrow or Broadband Operation to 2 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **11.5 dB gain @ 1.2 GHz**
- **+12V bias (No external bias resistor required)**
- **+3.0 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

DESCRIPTION

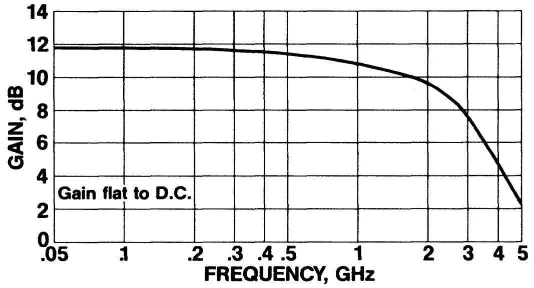
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

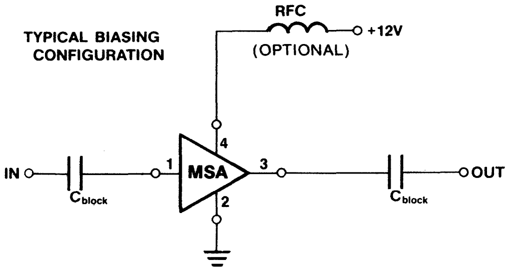
Avantek 70 mil Package



TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C, I = 25$ mA



TYPICAL BIASING CONFIGURATION



ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-11	12.0	25.0	0.1	dB	10.5	11.5	12.5
		-12					10.5	11.5	12.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	25.0	—	GHz	1.3		
		-12					1.0		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	25.0	—	GHz		5	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	25.0	—	GHz		4	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	25.0	0.5	dBm		3	
NF_{50}	50Ω Noise Figure		12.0	25.0	0.5	dB		6.0	
IP_3	Third Order Intercept Point		12.0	25.0	0.5	dBm		16.0	
HP_2	Second Harmonic Intercept Point		12.0	25.0	0.5	dBm		31.0	
t_D	Group Delay		12.0	25.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.
Note 2: An internal 45pf (Opt. C45) input blocking capacitor is available ($\lvert S_{21}\rvert^2$ is tested @ 200 MHz.)

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	30 mA	60 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

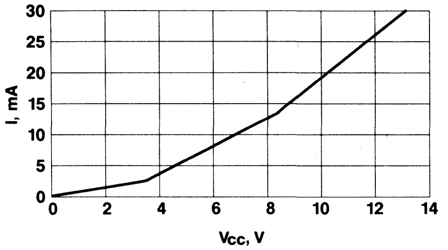
Thermal Resistance, θ_{jc}: 150° C/W

Notes:

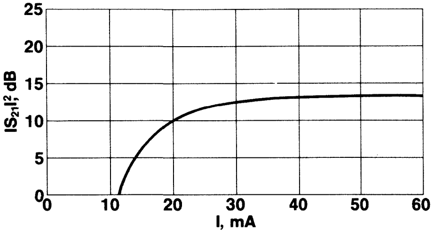
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

TYPICAL PERFORMANCE, T_A=25° C

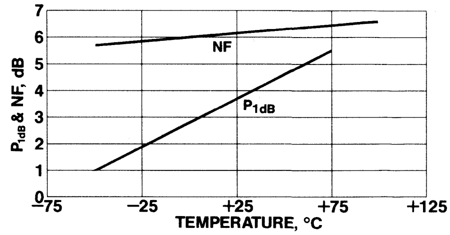
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



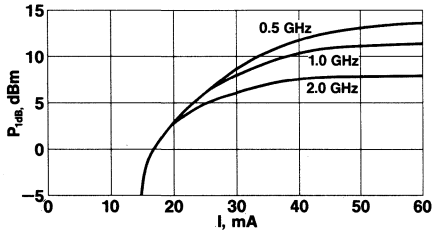
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



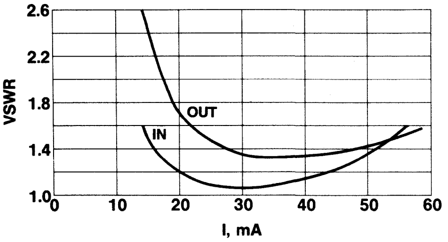
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=25 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0270-11 I = 25 mA (V = 12.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.02	93.1	11.93	175.8	.103	2.1	.08	-23.5
200	.02	83.4	11.91	169.9	.103	2.2	.08	-31.0
400	.03	70.8	11.74	158.7	.104	3.1	.09	-48.6
500	.04	58.5	11.70	153.4	.105	3.9	.10	-58.1
750	.06	35.8	11.50	138.1	.109	3.8	.13	-75.8
1000	.08	23.3	11.21	128.4	.114	4.6	.15	-90.3
1250	.08	6.8	10.97	114.5	.120	6.4	.15	-105.1
1500	.08	-9.3	10.68	101.5	.126	5.5	.17	-116.9
1750	.10	-29.1	10.29	88.9	.134	3.8	.18	-126.7
2000	.11	-49.5	9.83	76.5	.139	1.9	.19	-136.4
2500	.13	-88.7	8.62	53.5	.151	-2.6	.21	-149.7
3000	.17	-124.3	7.44	32.9	.159	-6.6	.23	-158.8
3500	.23	-160.3	6.12	14.1	.178	-6.4	.26	-170.0
4000	.22	173.8	4.85	-2.0	.217	-22.2	.25	-174.3

MSA-0270-12

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.04	103.7	11.84	175.1	.103	2.8	.08	-18.3
200	.05	88.5	11.80	168.4	.104	3.5	.07	-18.8
400	.08	74.6	11.59	155.6	.106	5.6	.07	-24.6
500	.10	65.4	11.46	149.5	.107	6.8	.06	-29.3
750	.15	43.7	11.34	122.6	.109	7.9	.05	-42.6
1000	.17	36.3	10.81	118.7	.118	9.7	.05	-65.2
1250	.18	28.5	10.26	107.7	.128	11.2	.04	-89.8
1500	.19	18.5	9.81	94.6	.137	10.7	.04	-124.3
1750	.18	8.0	9.28	82.1	.147	9.1	.05	-153.6
2000	.17	-3.8	8.73	69.9	.155	7.1	.07	-174.6
2500	.13	-25.1	7.45	47.7	.172	2.0	.12	160.4
3000	.08	-58.4	6.25	27.7	.184	-3.7	.18	145.2
3500	.07	-135.7	4.97	9.5	.192	-10.4	.25	132.6
4000	.18	159.6	3.36	-3.5	.197	-10.3	.33	113.5

MSA-0270-2X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

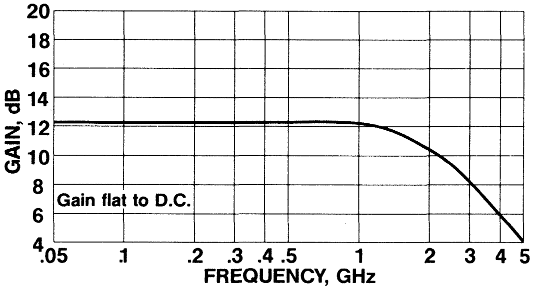
- **Narrow or Broadband Operation to 3 GHz**
- **Smooth Single Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **12.5 dB gain @ 1.5 GHz**
- **+5V bias (Note R_{bias} required)**
- **+4.0 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

DESCRIPTION

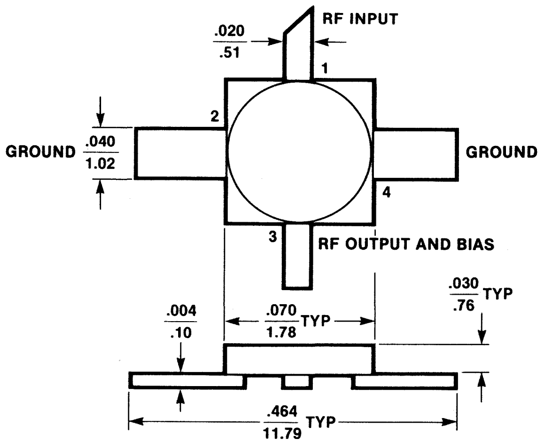
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

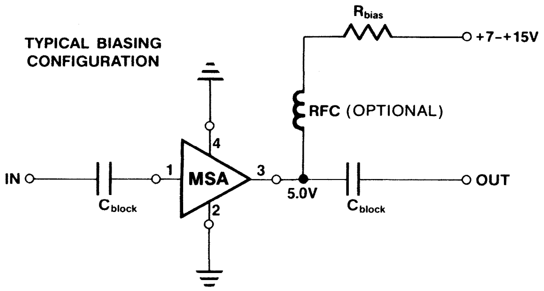
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

TYPICAL GAIN vs. FREQUENCY
T_A = 25°C, I = 25 mA



Avantek 70 mil Package





ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-21	5.0	25.0	0.1	dB	11.5	12.5	13.5
		-22					11.5	12.5	13.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-21	5.0	25.0	—	GHz	1.8		
		-22					1.4		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	25.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	25.0	—	GHz		5	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	25.0	0.5	dBm		4.0	
NF_{50}	50Ω Noise Figure		5.0	25.0	0.5	dB		6.0	
IP_3	Third Order Intercept Point		5.0	25.0	0.5	dBm		17	
HP_2	Second Harmonic Intercept Point		5.0	25.0	0.5	dBm		32.0	
t_D	Group Delay		5.0	25.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.
Note 2: An internal 45pf (Opt. C45) input blocking capacitor is available ($\lvert S_{21}\rvert^2$ is tested @ 200 MHz.)

RECOMMENDED MAXIMUM RATINGS

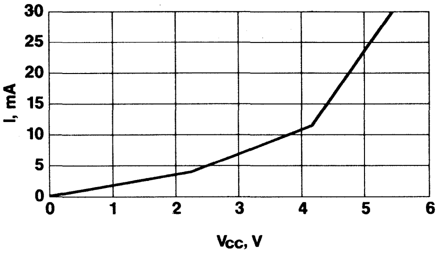
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	30 mA	60 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1×10^6 Hrs.	1×10^4 Hrs.

Thermal Resistance, θ_{jc}: 80° C/W

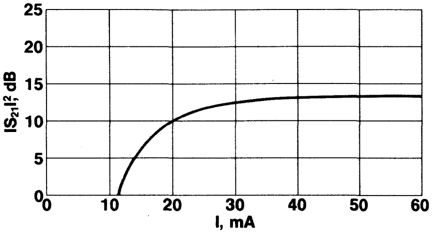
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

TYPICAL PERFORMANCE, T_A=25° C

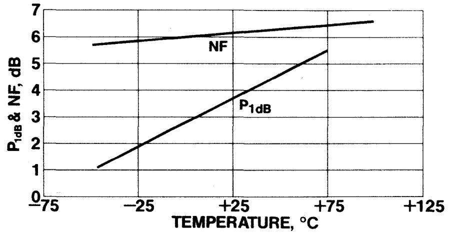
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



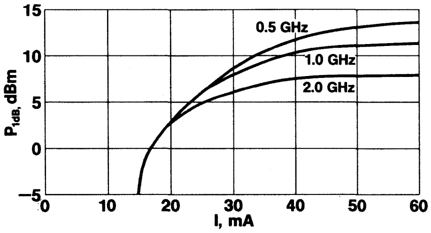
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



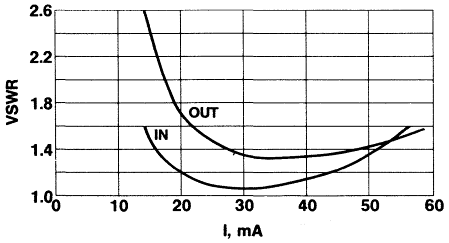
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=25 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0270-21 I = 25 mA (V = 5.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.03	179.0	12.30	175.0	.118	0.0	.21	-6.0
500	.02	-161.0	12.30	156.0	.121	0.0	.21	-29.0
1000	.05	-115.0	12.30	131.0	.126	-1.0	.20	-57.0
1200	.07	-114.0	12.20	122.0	.133	-1.0	.19	-69.0
1400	.10	-120.0	12.10	112.0	.137	-2.0	.18	-80.0
1600	.13	-127.0	11.90	101.0	.140	-3.0	.17	-90.0
1800	.16	-138.0	11.60	91.0	.146	-5.0	.16	-100.0
2000	.19	-148.0	11.30	81.0	.149	-6.0	.15	-109.0
2200	.23	-155.0	10.90	71.0	.153	-10.0	.14	-118.0
2400	.26	-165.0	10.40	61.0	.156	-12.0	.13	-122.0
2600	.29	-174.0	9.90	53.0	.158	-15.0	.13	-126.0
2800	.31	-178.0	9.40	42.0	.160	-19.0	.13	-129.0
3000	.33	171.0	8.80	36.0	.159	-21.0	.13	-130.0
4000	.43	139.0	6.60	0.0	.160	-32.0	.20	-140.0

MSA-0270-22

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.04	172.1	13.19	175.5	.112	1.0	.18	-6.4
200	.04	166.9	13.14	171.0	.113	1.4	.18	-14.3
400	.04	160.7	13.09	161.7	.113	2.5	.19	-28.3
500	.04	154.4	13.02	157.1	.114	3.1	.18	-35.4
750	.04	157.4	12.95	132.8	.115	3.8	.18	-54.2
1000	.04	156.1	12.92	131.6	.120	4.5	.19	-67.5
1250	.02	149.7	12.72	122.7	.129	5.0	.19	-87.6
1500	.03	167.7	12.55	110.9	.136	4.2	.20	-103.5
1750	.04	-177.4	12.33	98.9	.144	2.5	.20	-119.0
2000	.06	-173.2	12.01	87.3	.151	.5	.21	-134.9
2500	.11	178.1	11.07	65.0	.164	-4.2	.21	-161.4
3000	.17	164.5	10.09	44.8	.176	-10.1	.21	177.8
3500	.23	150.4	9.11	26.1	.187	-16.4	.20	162.1
4000	.29	136.7	7.92	8.2	.195	-23.9	.19	151.9

MSA-0335-1X MODAMP™
Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

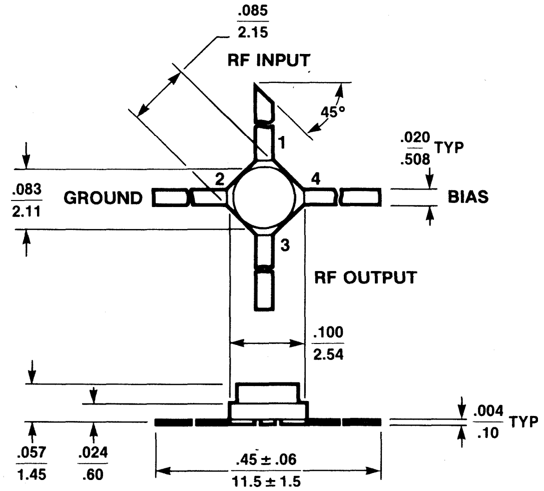
- **Broadband and Narrowband Gain to 2 GHz**
- **Smooth Single-Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **11 dB gain @ 900 MHz**
- **+12V bias (No external bias resistor required)**
- **+9.0 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

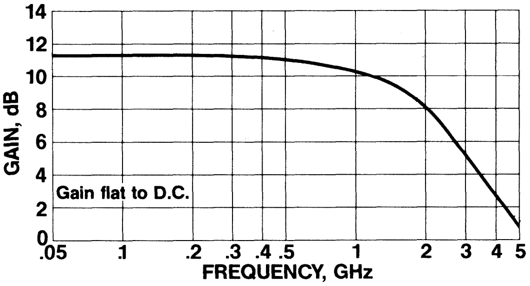
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

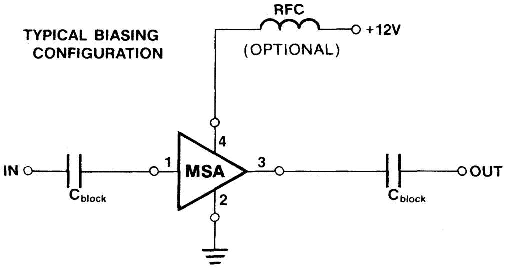
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C, I = 35$ mA





ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-11	12.0	35.0	0.1	dB	10.5	11.5	12.5
		-12					10.5	11.5	12.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	35.0	—	GHz	1.0		
		-12					0.8		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	35.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	35.0	—	GHz		3.0	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	35.0	0.5	dBm		9.0	
NF_{50}	50Ω Noise Figure		12.0	35.0	0.5	dB		5.5	
IP_3	Third Order Intercept Point		12.0	35.0	0.5	dBm		22	
HP_2	Second Harmonic Intercept Point		12.0	35.0	0.5	dBm		38.0	
t_D	Group Delay		12.0	35.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

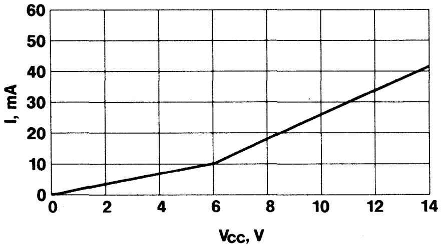
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	40 mA	80 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10^6 Hrs.	1x10^4 Hrs.

Thermal Resistance, θ_{jc}: 160° C/W

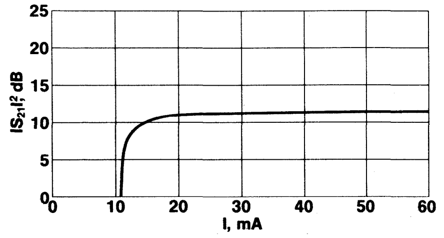
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above +150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, T_A=25° C

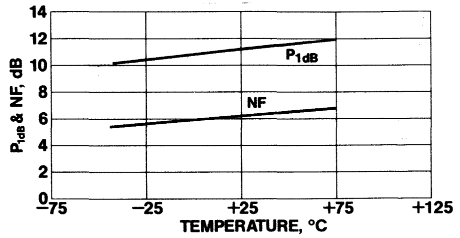
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



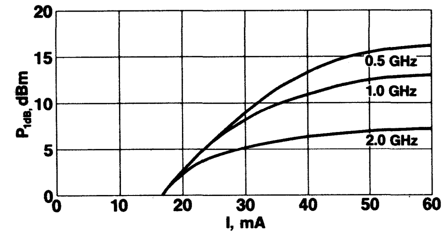
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



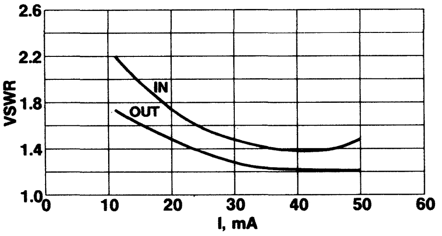
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=35 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0335-11

I = 35 mA (V = 12.0V Typ.)

Freq. MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	Mag	Ang	dB	Ang	Mag	Ang	Mag	Ang
100	.04	20.4	11.50	173.5	.102	1.7	.04	-17.0
200	.05	30.3	11.41	167.1	.102	3.3	.05	-35.3
400	.08	34.1	11.22	154.3	.104	6.0	.06	-64.9
500	.09	31.2	11.07	148.0	.106	7.6	.06	-79.1
750	.12	23.2	10.81	120.8	.117	8.5	.07	-106.4
1000	.14	6.9	10.62	119.4	.121	11.5	.09	-110.3
1250	.14	-4.9	9.97	104.4	.129	13.5	.13	-142.2
1500	.14	-18.6	9.49	90.4	.141	13.1	.16	-157.0
1750	.13	-38.0	8.97	77.0	.153	11.3	.18	-170.1
2000	.12	-59.6	8.35	64.0	.163	8.9	.22	178.3
2500	.11	-112.2	6.96	40.5	.182	2.4	.27	158.5
3000	.16	-158.7	5.51	19.5	.196	-4.5	.32	143.8
3500	.25	171.5	4.01	2.6	.202	-11.0	.39	-129.6
4000	.36	137.3	3.07	-10.2	.224	-14.0	.40	-114.4
MSA-0335-12								
100	.02	79.1	11.71	173.3	.107	2.1	.06	-8.3
200	.04	73.6	11.65	166.7	.108	3.7	.06	-19.4
400	.07	62.2	11.43	153.4	.110	6.8	.06	-39.6
500	.08	52.9	11.29	146.9	.112	8.5	.06	-51.0
750	.13	33.3	11.00	120.7	.118	8.5	.06	-84.4
1000	.13	16.7	10.43	114.5	.128	11.8	.07	-101.4
1250	.13	3.1	10.03	102.4	.138	15.0	.08	-129.4
1500	.12	-13.4	9.50	88.4	.151	14.8	.10	-150.4
1750	.11	-36.1	8.94	75.0	.164	13.2	.11	-167.0
2000	.09	-64.3	8.31	62.2	.175	10.9	.14	179.2
2500	.09	-135.5	6.93	39.1	.197	5.0	.19	157.8
3000	.16	178.8	5.54	18.8	.214	-1.2	.24	143.0
3500	.25	154.1	4.18	1.2	.226	-7.6	.30	129.7
4000	.37	128.1	3.01	-11.5	.247	-12.0	.34	113.4

MSA-0335-2X MODAMP™
Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

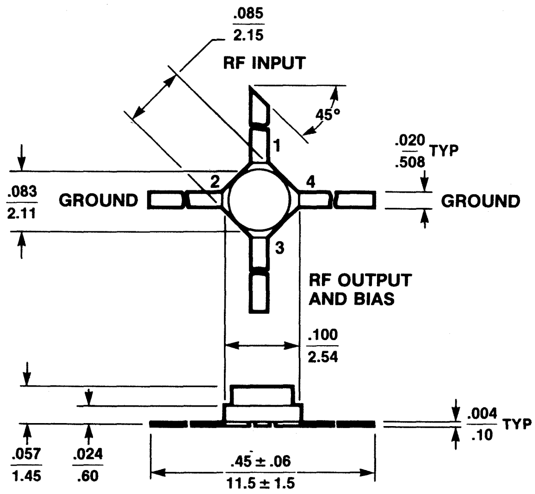
- **Broadband and Narrowband Gain to 3 GHz**
- **Smooth Single-Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **12 dB gain @ 1.5 GHz**
- **+5.0V bias (Note R_{bias} required)**
- **+10 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Low Cost Package**

DESCRIPTION

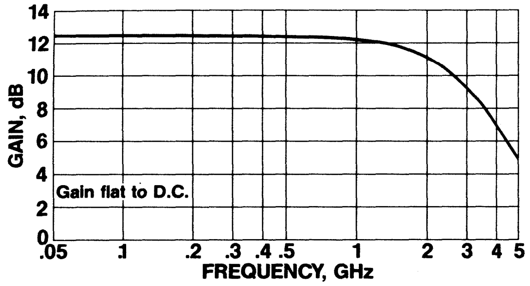
The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

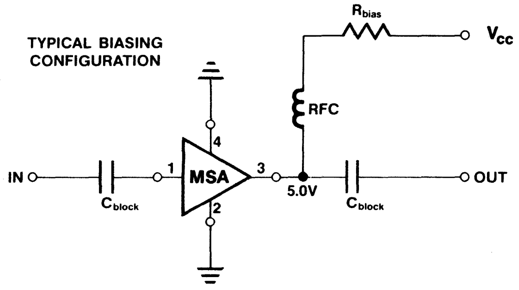
These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required. Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

Avantek Micro-X Package



TYPICAL GAIN vs. FREQUENCY
T_A = 25°C, I = 35 mA





ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-21 -22	5.0	35.0	0.1	dB	11.5 11.5	12.5 12.5	13.5 13.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-21 -22	5.0	35.0	—	GHz	1.6 1.3		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	35.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	35.0	—	GHz		3.0	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	35.0	0.5	dBm		10.0	
NF_{50}	50Ω Noise Figure		5.0	35.0	0.5	dB		5.5	
IP_3	Third Order Intercept Point		5.0	35.0	0.5	dBm		23	
HP_2	Second Harmonic Intercept Point		5.0	35.0	0.5	dBm		39	
t_D	Group Delay		5.0	35.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS

Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	40 mA	80 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature[3]	—	200° C
MT.T.F. (Projected)	1x10⁶ Hrs.	1x10⁴ Hrs.

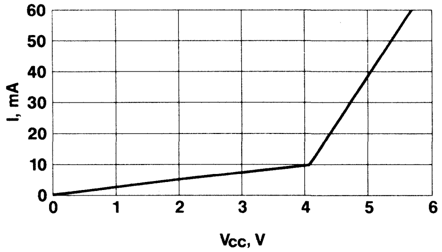
Thermal Resistance, θ_{jc}: 90° C/W

Notes:

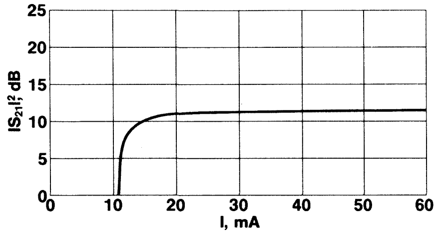
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. Storage above +150° C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200° C.

TYPICAL PERFORMANCE, T_A=25° C

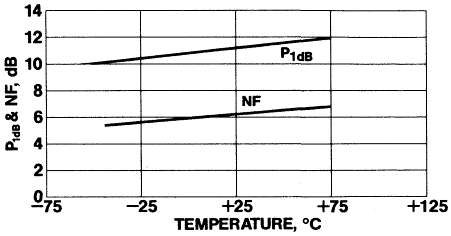
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



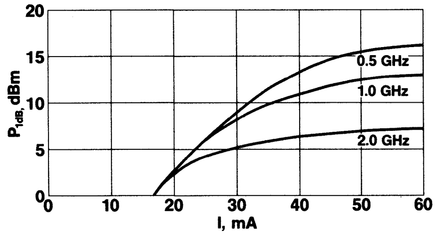
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



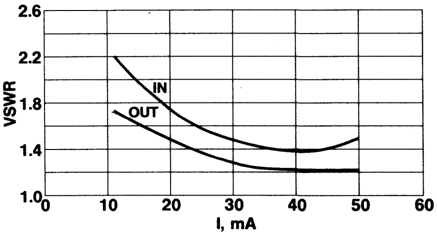
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=35 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0335-21

I = 35 mA (V = 5.0V Typ.)

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.09	178.0	12.30	177.0	.124	2.0	.13	-6.0
200	.08	175.0	12.30	174.0	.125	4.0	.13	-13.0
400	.08	175.0	12.20	166.0	.121	8.0	.14	-27.0
600	.07	172.0	12.10	159.0	.126	13.0	.14	-40.0
800	.07	172.0	12.10	155.0	.131	17.0	.14	-52.0
1000	.06	-179.0	12.00	146.0	.129	19.0	.15	-64.0
1200	.06	-170.0	11.80	141.0	.137	24.0	.16	-76.0
1400	.06	-157.0	11.70	134.0	.144	28.0	.16	-88.0
1600	.07	-142.0	11.50	128.0	.145	28.0	.17	-99.0
1800	.09	-138.0	11.30	122.0	.154	32.0	.18	-108.0
2000	.12	-137.0	11.00	115.0	.161	36.0	.19	-117.0
3000	.25	-145.0	9.20	88.0	.185	41.0	.22	-146.0
4000	.37	-163.0	6.80	67.0	.206	44.0	.20	-153.0

MSA-0335-22

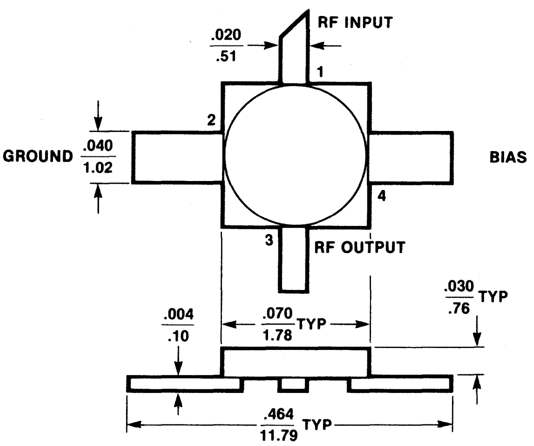
Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.07	172.7	12.15	175.0	.124	.3	.15	-6.6
200	.07	165.9	12.09	170.0	.124	1.1	.15	-16.7
400	.06	157.5	11.97	160.0	.125	2.7	.15	-29.5
500	.06	150.0	11.92	155.0	.126	3.4	.15	-38.1
750	.05	105.6	11.80	137.0	.134	-6.6	.13	-55.5
1000	.06	132.4	11.60	131.1	.184	-5.2	.17	-70.9
1500	.03	-175.2	11.41	106.4	.152	8.2	.17	-107.6
2000	.08	-158.8	10.90	81.9	.172	5.7	.18	-137.8
2500	.15	-175.2	9.93	58.5	.191	-.2	.20	-164.3
3000	.22	167.6	8.82	36.6	.203	-6.3	.21	174.5
3500	.29	150.3	7.63	17.3	.208	-11.7	.21	158.2
4000	.34	134.2	6.30	1.1	.215	-18.0	.22	149.7

MSA-0370-1X MODAMP™
Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

- **Broadband and Narrowband Gain to 2 GHz**
- **Smooth Single-Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **11 dB gain @ 1.2 GHz**
- **+12V bias (No external bias resistor required)**
- **+9 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

Avantek 70 mil Package

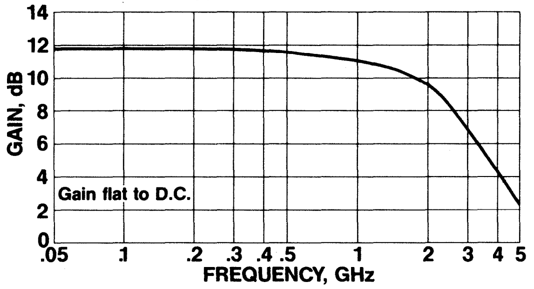


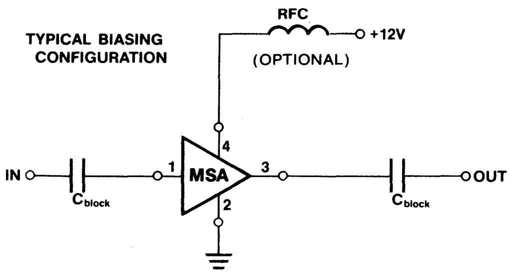
DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. External blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C, I = 35$ mA





ELECTRICAL SPECIFICATIONS, T_A = 25° C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\vert S_{21}\vert^2$	Insertion Power Gain	-11	12.0	35.0	0.1	dB	10.5	11.5	12.5
		-12					10.5	11.5	12.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-11	12.0	35.0	—	GHz	1.3		
		-12					1.0		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		12.0	35.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		12.0	35.0	—	GHz		3.0	
P_{1dB}	Output Power at 1 dB Gain Compression		12.0	35.0	0.5	dBm		9.0	
NF_{50}	50Ω Noise Figure		12.0	35.0	0.5	dB		5.5	
IP_3	Third Order Intercept Point		12.0	35.0	0.5	dBm		22	
HP_2	Second Harmonic Intercept Point		12.0	35.0	0.5	dBm		38	
t_D	Group Delay		12.0	35.0	0.5	ps		100	

Note 1: Frequency at which gain is 1 dB less than at 100 MHz.
Note 2: An internal 45pf (Opt. C45) input blocking capacitor is available ($|S_{21}|^2$ is tested @ 200 MHz.)

RECOMMENDED MAXIMUM RATINGS

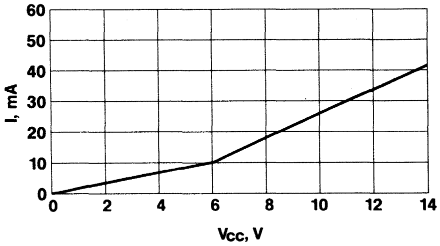
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	12V	14V
Power Supply Current	40 mA	80 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1×10^6 Hrs.	1×10^4 Hrs.

Thermal Resistance, θ_{jc}: 150° C/W

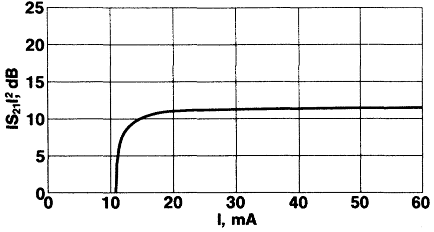
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

TYPICAL PERFORMANCE, T_A=25° C

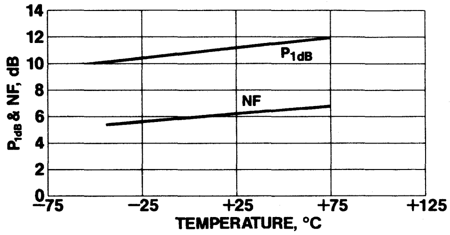
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



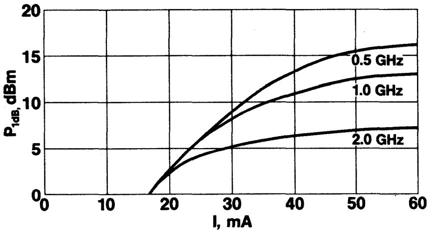
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



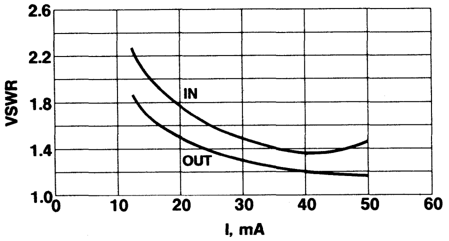
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE
I=35 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT
FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0370-11

I = 35 mA (V = 12.0V Typ.)

Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.03	150.1	11.32	176.0	.101	2.2	.04	-120.5
200	.03	140.6	11.33	170.2	.102	2.4	.06	-125.1
400	.03	120.3	11.22	159.2	.103	3.6	.08	-123.5
500	.03	100.2	11.17	153.9	.103	4.5	.10	-125.6
750	.03	41.2	11.01	128.3	.108	-4.4	.14	-132.2
1000	.04	17.2	10.81	124.2	.116	5.1	.21	-138.1
1250	.04	-20.8	10.63	114.7	.119	7.2	.20	-142.6
1500	.06	-50.7	10.34	101.4	.127	6.4	.24	-149.9
1750	.08	-77.7	9.93	88.3	.133	4.3	.25	-156.9
2000	.10	-100.1	9.43	75.5	.139	2.2	.28	-164.2
2500	.16	-134.1	8.13	52.1	.148	-2.3	.30	-175.7
3000	.23	-160.5	6.80	31.4	.154	-5.3	.31	176.5
3500	.31	170.1	5.43	14.4	.183	-3.8	.33	167.0
4000	.29	152.5	4.25	-2.7	.207	-22.2	.32	166.5

MSA-0370-12

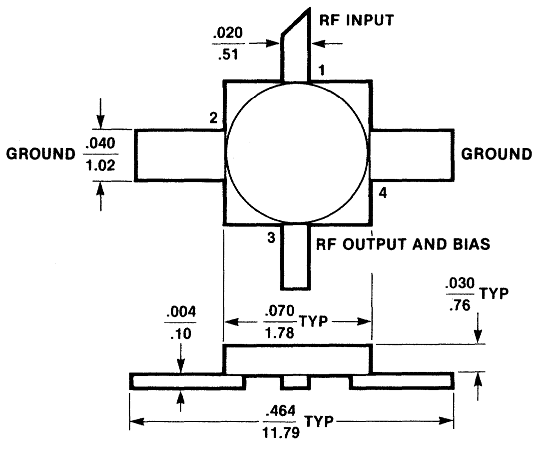
Freq. MHz	S11 Mag	S11 Ang	S21 dB	S21 Ang	S12 Mag	S12 Ang	S22 Mag	S22 Ang
100	.03	6.3	11.89	174.7	.106	1.3	.09	-15.0
200	.03	9.1	11.85	169.3	.106	2.4	.09	-30.9
400	.03	4.7	11.71	158.3	.107	4.6	.11	-55.1
500	.04	-1.2	11.64	152.9	.109	5.9	.12	-66.5
750	.06	18.1	11.48	138.8	.110	6.9	.14	-83.8
1000	.08	-23.7	11.26	125.6	.118	8.9	.20	-95.8
1250	.09	-53.1	11.06	113.4	.128	10.9	.21	-116.5
1500	.11	-70.7	10.72	100.0	.138	10.5	.24	-128.9
1750	.13	-90.0	10.36	87.0	.148	8.9	.26	-139.5
2000	.16	-108.0	9.85	74.3	.156	7.0	.28	-150.2
2500	.21	-138.4	8.59	51.0	.172	2.4	.29	-166.1
3000	.27	-163.2	7.30	30.5	.185	-1.9	.30	-177.1
3500	.35	172.2	6.03	12.4	.213	-4.1	.32	173.0
4000	.35	151.7	4.69	-3.3	.240	-19.9	.31	164.9

MSA-0370-2X MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

- **Broadband and Narrowband Gain to 3 GHz**
- **Smooth Single-Pole Gain Rolloff**
- **Fully Cascadable (VSWR <2:1)**
- **12 dB gain @ 1.6 GHz**
- **+5V bias (Note R_{bias} required)**
- **+10 dBm P_{1dB} @ 500 MHz**
- **Short Group Delay**
- **Hermetic, High Reliability Package**

Avantek 70 mil Package

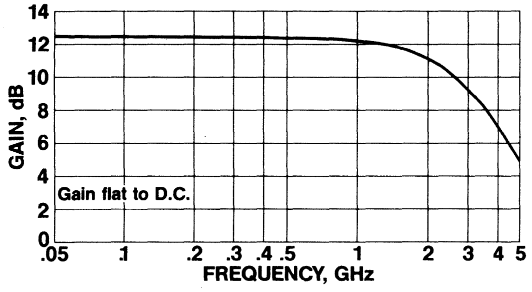


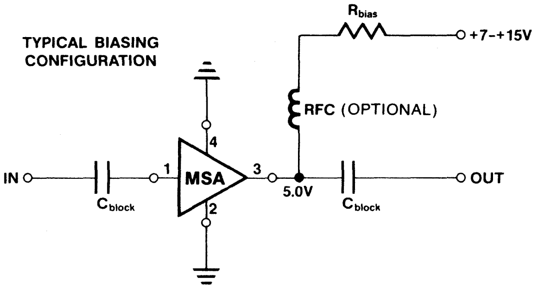
DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and external blocking capacitors are required.[2] Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land based systems.

TYPICAL GAIN vs. FREQUENCY
$T_A = 25°C$, I = 35 mA





ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters/Test Conditions	Model No.	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\lvert S_{21}\rvert^2$	Insertion Power Gain	-21	5.0	35.0	0.1	dB	11.5	12.5	13.5
		-22					11.5	12.5	13.5
f_{1dB}	Frequency at -1dB Gain Point[1]	-21	5.0	35.0	—	GHz	1.8		
		-22					1.4		
f_{SWR}(IN)	Freq. at VSWR = 2:1 (INPUT)		5.0	35.0	—	GHz		3.0	
f_{SWR}(OUT)	Freq. at VSWR = 2:1 (OUTPUT)		5.0	35.0	—	GHz		3.0	
P_{1dB}	Output Power at 1 dB Gain Compression		5.0	35.0	0.5	dBm		10.0	
NF_{50}	50Ω Noise Figure		5.0	35.0	0.5	dB		5.5	
IP_3	Third Order Intercept Point		5.0	35.0	0.5	dBm		23	
HP_2	Second Harmonic Intercept Point		5.0	35.0	0.5	dBm		39	
t_D	Group Delay		5.0	35.0	0.5	ps		100	

Note 1: Frequency at which gain is 1dB less than at 100 MHz.
Note 2: An internal 45pf (Opt. C45) input blocking capacitor is available ($\lvert S_{21}\rvert^2$ is tested @ 200 MHz.)

RECOMMENDED MAXIMUM RATINGS

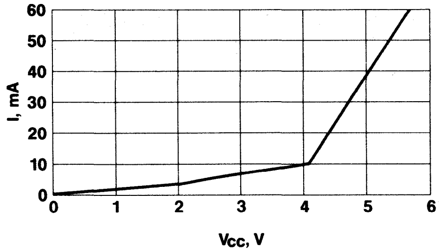
Parameter	Cont.[1] Oper.	Abs.[2] Max.
Power Supply Voltage	5.0V	6.0V
Power Supply Current	40 mA	80 mA
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150° C	200° C
Storage Temperature	—	200° C
MT.T.F. (Projected)	1x10^6 Hrs.	1x10^4 Hrs.

Thermal Resistance, θ_{jc}: 80° C/W

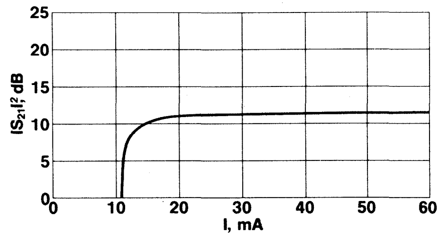
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

TYPICAL PERFORMANCE, T_A=25° C

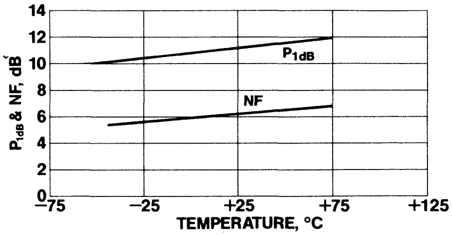
TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE



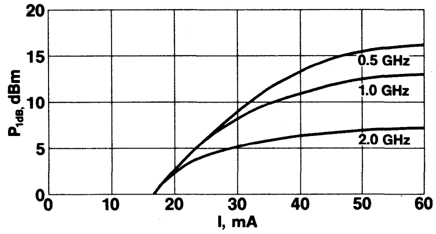
INSERTION POWER GAIN AT 0.1 GHz ($|S_{21}|^2$) vs. CURRENT



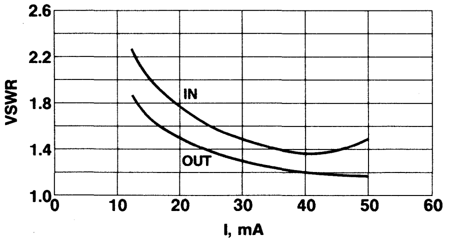
OUTPUT POWER AT 1dB GAIN COMPRESSION AND NOISE FIGURE vs. CASE TEMPERATURE I=35 mA, FREQ.=500 MHz



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. CURRENT AND FREQUENCY



VSWR vs. CURRENT FREQUENCY = 1.0 GHz



TYPICAL SCATTERING PARAMETERS*

MSA-0370-21 I = 35 mA (V = 5.0V Typ.)

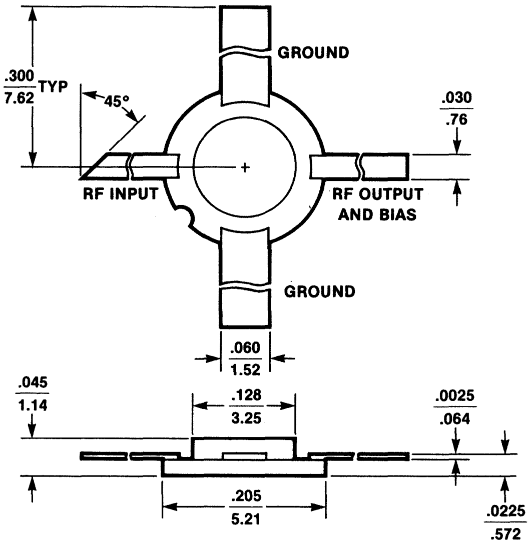
Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.09	179.0	12.30	175.0	.122	1.0	.13	-10.0
500	.09	-179.0	12.20	156.0	.123	1.0	.14	-50.0
1000	.09	-169.0	12.20	134.0	.133	3.0	.18	-90.0
1200	.10	-164.0	12.10	124.0	.135	1.0	.20	-103.0
1400	.11	-161.0	12.00	114.0	.141	2.0	.21	-117.0
1600	.13	-157.0	11.80	104.0	.147	-1.0	.23	-130.0
1800	.16	-160.0	11.60	95.0	.152	-1.0	.25	-140.0
2000	.19	-164.0	11.40	86.0	.158	-5.0	.26	-153.0
2200	.22	-167.0	11.10	77.0	.161	-5.0	.27	-162.0
2400	.26	-174.0	10.70	67.0	.170	-8.0	.27	-171.0
2600	.29	179.0	10.30	57.0	.172	-9.0	.28	180.0
2800	.32	173.0	9.90	48.0	.176	-14.0	.28	172.0
3000	.34	167.0	9.30	41.0	.177	-16.0	.28	166.0
4000	.44	141.0	6.80	6.0	.188	-28.0	.27	146.0

MSA-0370-22

Freq. MHz	S_{11} Mag	S_{11} Ang	S_{21} dB	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
100	.05	178.7	12.30	175.3	.123	-.2	.17	-8.4
200	.05	178.7	12.26	170.5	.123	.3	.17	-18.9
400	.05	-175.0	12.17	161.0	.123	1.0	.18	-33.8
500	.05	-172.4	12.14	156.2	.124	1.6	.18	-43.0
750	.02	-175.1	12.10	139.3	.132	-8.9	.17	-61.7
1000	.06	-168.4	12.00	133.3	.182	-11.1	.23	-78.0
1500	.11	-128.7	11.89	107.9	.148	2.9	.24	-106.6
2000	.18	-141.3	11.45	82.5	.167	-1.3	.26	-129.9
2500	.26	-159.5	10.43	58.3	.182	-8.9	.27	-148.9
3000	.32	-177.4	9.23	35.3	.191	-16.2	.26	-162.2
3500	.37	165.2	7.90	15.7	.193	-23.0	.24	-170.4
4000	.39	149.2	6.41	-.8	.199	-30.3	.24	-172.4

MSA-0420 MODAMP™
Cascadable Monolithic Silicon Integrated Circuit Amplifier

Avantek .200 BeO Disc Package



FEATURES

- **Narrow or Broadband Operation To 2.5 GHz**
- **Fully Cascadable**
- **Short Group Delay**
- **Smooth Single Pole Gain Rolloff**
- **Rugged**
  - **Tolerant to RF Input and Bias Overloads**
  - **Hermetic .200 BeO Disc Package**
- **Excellent Temperature Stability**
- **Low Distortion**

DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and choke are required for biasing. External blocking capacitors are also required.

Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land-based systems.

ELECTRICAL SPECIFICATIONS ($T_A = 25°C$)

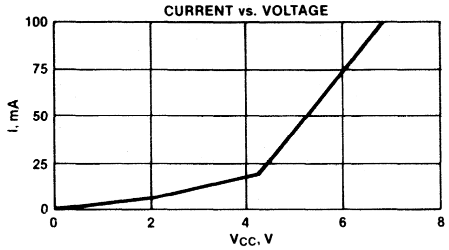
Symbol	Parameters	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	6.5	90	0.1	dB	7.5	8.5	9.5
$f_{1\,dB}$	Frequency at −1 dB Gain Point[1]	6.5	90	—	GHz	2.0	2.5	
$f_{SWR}(IN)$	Frequency at VSWR = 2:1 (INPUT)	6.5	90	—	GHz		3.0	
$f_{SWR}(OUT)$	Frequency at VSWR = 2:1 (OUTPUT)	6.5	90	—	GHz		2.0	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	6.5	90	0.5	dBm	17	19	
NF_{50}	50Ω Noise Figure	6.5	90	0.5	dB		6.0	
IP_3	Third Order Intercept Point	6.5	90	0.5	dBm		34	
HP_2	Second Harmonic Intercept Point	6.5	90	0.5	dBm		55	
t_D	Group Delay	6.5	90	0.5	ps		150	

Note: 1. Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS, $T_A = 25°C$

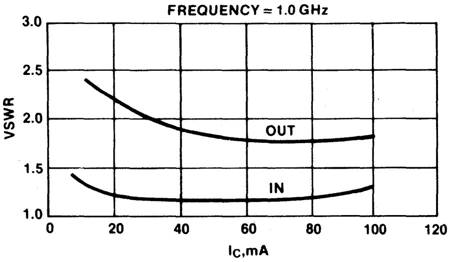
Parameter	Cont. Oper.	Abs. Max.
Power Supply Current	90 mA	120 mA
Case Temperature, Storage	—	200°C
Continuous RF Input Power	+ 16 dBm	+ 20 dBm
Junction Temperature	150°C	200°C
M.T.T.F. (Projected), Hrs	1×10^6	1×10^4
Thermal Resistance, Θ_{jc} (Junction to Case)	—	65°C/W

TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE

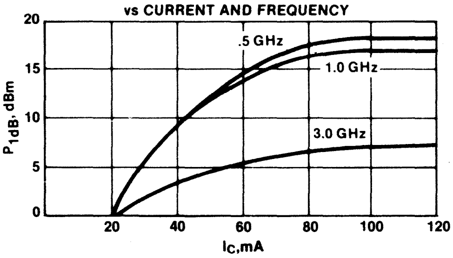


TYPICAL SCATTERING PARAMETERS,* MSA-0420

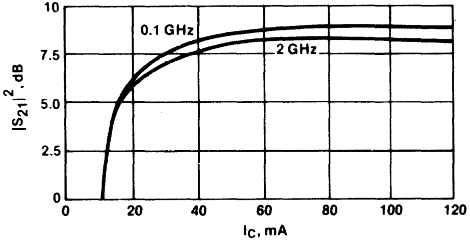
VSWR vs CURRENT FREQUENCY = 1.0 GHz



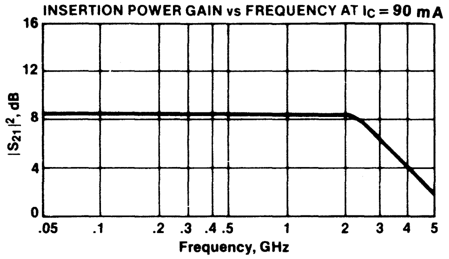
OUTPUT POWER AT 1dB GAIN COMPRESSION vs CURRENT AND FREQUENCY



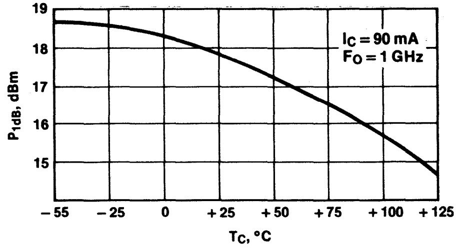
INSERTION POWER GAIN vs CURRENT AND FREQUENCY

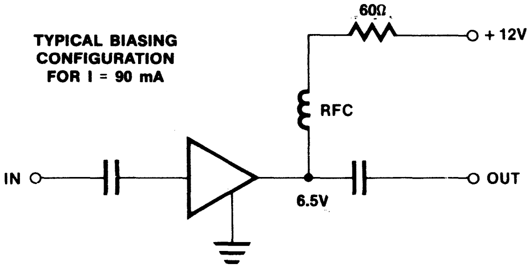


INSERTION POWER GAIN vs FREQUENCY AT $I_C = 90$ mA



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. TEMPERATURE




TYPICAL BIASING CONFIGURATION FOR I = 90 mA

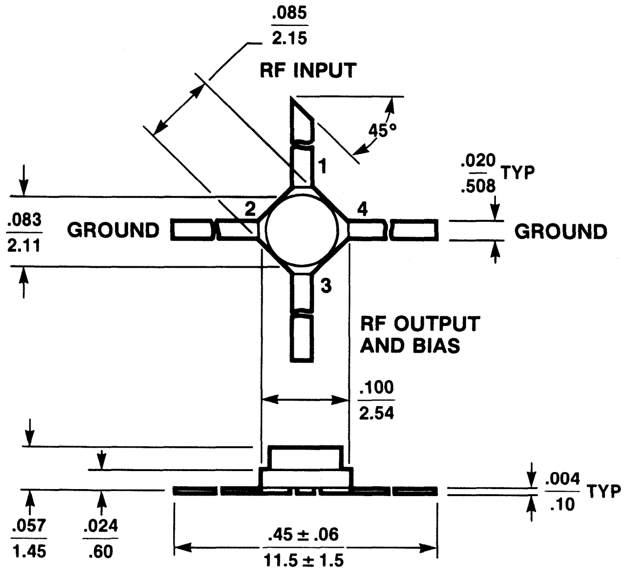
TYPICAL SCATTERING PARAMETERS,* MSA-0420

I = 90 mA(V = 6.5V Typ.)

Freq. MHz	Reflection Coefficient, In S_{11} Mag	Ang	Gain, Forward S_{21} dB	Mag	Ang	Loss, Reverse S_{12} Mag	Ang	Reflection Coefficient, Out S_{22} Mag	Ang
100	.04	− 179.8	8.50	2.66	175.3	.153	.6	.23	− 7.4
500	.04	− 179.4	8.47	2.65	154.8	.155	1.3	.24	− 38.6
1000	.04	− 165.1	8.45	2.64	129.6	.162	2.2	.27	− 72.5
1200	.06	− 160.1	8.41	2.63	119.2	.168	1.1	.28	− 87.6
1400	.07	− 153.1	8.32	2.61	108.8	.171	1.6	.30	− 100.5
1600	.08	− 153.2	8.26	2.59	99.4	.179	.6	.31	− 111.8
1800	.10	− 153.8	8.11	2.55	82.1	.186	− 1.9	.33	− 123.7
2000	.13	− 160.8	7.98	2.51	79.3	.192	− 1.6	.33	− 135.3
2200	.15	− 165.5	7.77	2.45	68.7	.203	− 4.2	.35	− 144.7
2400	.18	− 172.5	7.53	2.38	59.9	.208	− 5.9	.36	− 153.1
2600	.20	− 177.8	7.25	2.31	49.5	.216	− 8.6	.37	− 162.7
2800	.23	− 173.6	6.98	2.23	39.5	.224	− 12.6	.38	− 172.4
3000	.25	− 168.4	6.54	2.12	32.4	.227	− 14.0	.39	− 178.0

MSA-0435 MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

Avantek Micro-X Package



FEATURES

- Narrow or Broadband Operation To 2.5 GHz
- Fully Cascadable
- Short Group Delay
- Smooth Gain Rolloff
- Rugged
  - Tolerant to RF Input and Bias Overloads
  - Hermetic Micro-X Package
- Excellent Temperature Stability
- Low Distortion

DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and choke are required for biasing. External blocking capacitors are also required.

Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land-based systems.

ELECTRICAL SPECIFICATIONS ($T_A = 25°C$)

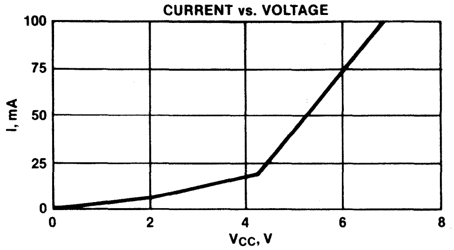
Symbol	Parameters	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	5.5	50	0.1	dB	7.5	8.5	9.5
$f_{1\,dB}$	Frequency at −1 dB Gain Point[1]	5.5	50	—	GHz	2.0	2.5	
f_{SWR}(IN)	Frequency at VSWR = 2:1 (INPUT)	5.5	50	—	GHz		2.5	
f_{SWR}(OUT)	Frequency at VSWR = 2:1 (OUTPUT)	5.5	50	—	GHz		3.0	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	5.5	50	0.5	dBm		13	
NF_{50}	50Ω Noise Figure	5.5	50	0.5	dB		6.0	
IP_3	Third Order Intercept Point	5.5	50	0.5	dBm		28	
HP_2	Second Harmonic Intercept Point	5.5	50	0.5	dBm		53	
t_D	Group Delay	5.5	50	0.5	ps		100	

Note: 1. Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS, $T_A = 25°C$

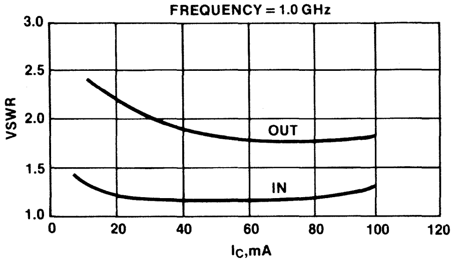
Parameter	Cont. Oper.	Abs. Max.
Power Supply Current	50 mA	100 mA
Case Temperature, Storage	—	200°C
Continuous RF Input Power	+16 dBm	+20 dBm
Junction Temperature	150°C	200°C
M.T.T.F. (Projected), Hrs	1×10^6	1×10^4
Thermal Resistance, Θ_{jc} (Junction to Case)	—	140°C/W

TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE

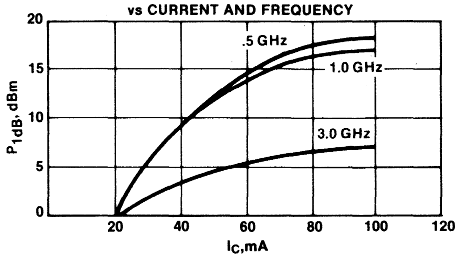


TYPICAL PERFORMANCE CURVES ($T_A = 25°C$), MSA-0435

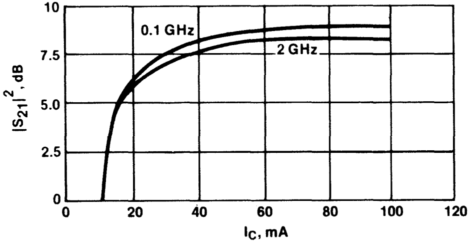
VSWR vs CURRENT FREQUENCY = 1.0 GHz



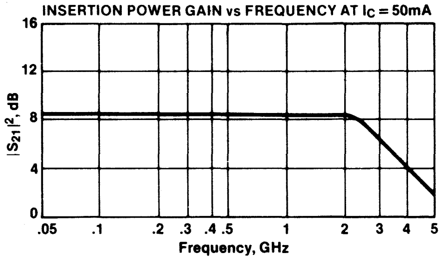
OUTPUT POWER AT 1dB GAIN COMPRESSION vs CURRENT AND FREQUENCY



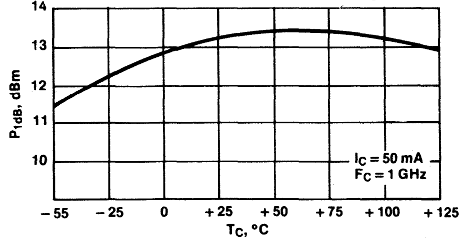
INSERTION POWER GAIN vs CURRENT AND FREQUENCY



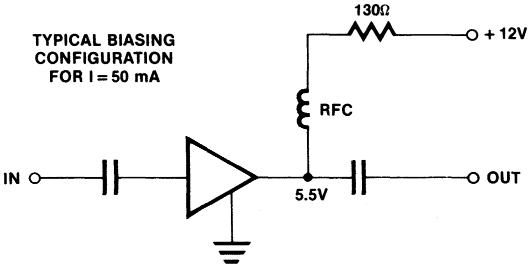
INSERTION POWER GAIN vs FREQUENCY AT $I_C = 50mA$



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. TEMPERATURE



TYPICAL BIASING CONFIGURATION FOR I = 50 mA



TYPICAL SCATTERING PARAMETERS,* MSA-0435

I = 50 mA (V = 5.5V Typ.)

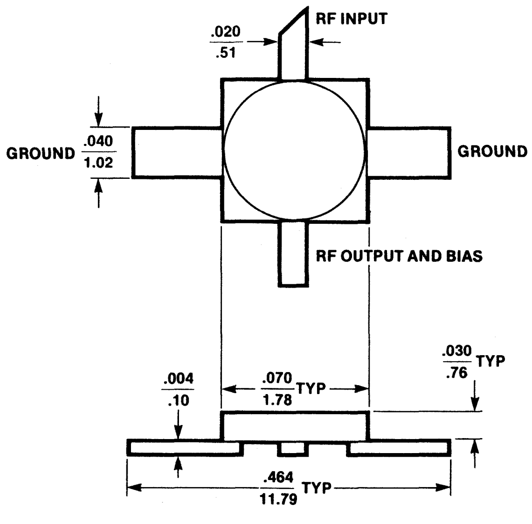
Freq. MHz	Reflection Coefficient, In S_{11}		Gain, Forward S_{21}			Loss, Reverse S_{12}		Reflection Coefficient, Out S_{22}	
	Mag	Ang	dB	Mag	Ang	Mag	Ang	Mag	Ang
100	.10	−179.3	8.24	2.58	174.4	.153	.6	.17	−7.9
500	.10	−173.7	8.28	2.59	154.8	.154	1.1	.18	−39.7
1000	.12	−160.9	8.40	2.63	129.3	.161	1.1	.21	−78.2
1200	.14	−156.9	8.44	2.64	119.4	.166	1.0	.22	−92.2
1400	.17	−156.2	8.38	2.63	108.5	.172	.4	.23	−106.9
1600	.20	−159.6	8.35	2.62	97.7	.179	−.6	.25	−120.0
1800	.24	−163.1	8.20	2.57	86.5	.187	−1.7	.26	−132.4
2000	.28	−168.8	7.96	2.50	75.6	.193	−3.2	.27	−144.4
2200	.32	−177.6	7.60	2.40	65.1	.199	−4.9	.28	−155.5
2400	.36	−176.0	7.29	2.31	55.2	.202	−7.2	.29	−165.6
2600	.39	−170.4	6.87	2.21	45.8	.205	−9.9	.29	−173.9
2800	.42	−162.1	6.36	2.08	36.7	.210	−13.0	.30	−177.3
3000	.46	−155.1	5.88	1.97	27.2	.214	−15.6	.30	−170.1

MSA-0470 MODAMP™ Cascadable Monolithic Silicon Integrated Circuit Amplifier

FEATURES

- **Narrow or Broadband Operation To 2.5 GHz**
- **High P_{1dB}**
- **Fully Cascadable**
- **Short Group Delay**
- **Smooth Single Pole Gain Rolloff**
- **Rugged**
  Tolerant to RF Input and Bias Overloads
  Hermetic .200 BeO Disc Package
- **Excellent Temperature Stability**
- **Low Distortion**

Avantek 70 mil Package



DESCRIPTION

The MSA (Monolithic Silicon Amplifier) series is a family of silicon bipolar Monolithic Microwave Integrated Circuits (MMIC) using nitride self-alignment, ion-implantation for precise control of doping and nitride passivation for high reliability.

These MMICs use series and shunt feedback and exhibit very high uniformity from amplifier to amplifier. An external current limiting resistor and choke are required for biasing. External blocking capacitors are also required.

Typical applications include narrow or broadband IF and RF amplifiers in military and commercial mobile, airborne and land-based systems.

ELECTRICAL SPECIFICATIONS ($T_A = 25°C$)

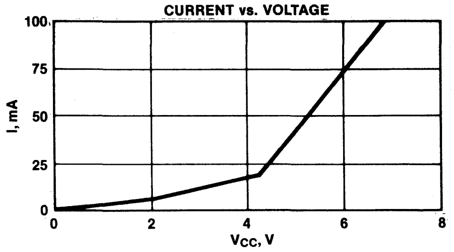
Symbol	Parameters	Typical Volts	Current (mA)	Freq. (GHz)	Units	Min.	Typ.	Max.
$\|S_{21}\|^2$	Insertion Power Gain	5.5	50	0.1	dB	7.5	8.5	9.5
$f_{1\,dB}$	Frequency at − 1 dB Gain Point[1]	5.5	50	—	GHz	2.0	2.5	
f_{SWR}(IN)	Frequency at VSWR = 2:1 (INPUT)	5.5	50	—	GHz		2.5	
f_{SWR}(OUT)	Frequency at VSWR = 2:1 (OUTPUT)	5.5	50	—	GHz		1.5	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	5.5	50	0.5	dBm		13	
NF_{50}	50Ω Noise Figure	5.5	50	0.5	dB		6.0	
IP_3	Third Order Intercept Point	5.5	50	0.5	dBm		28	
HP_2	Second Harmonic Intercept Point	5.5	50	0.5	dBm		53	
t_D	Group Delay	5.5	50	0.5	ps		100	

Note: 1. Frequency at which gain is 1 dB less than at 100 MHz.

RECOMMENDED MAXIMUM RATINGS, $T_A = 25°C$

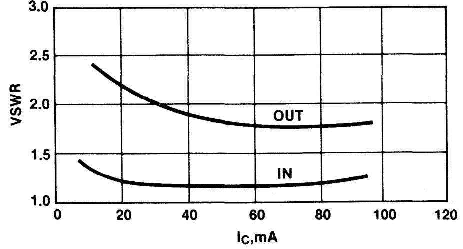
Parameter	Cont. Oper.	Abs. Max.
Power Supply Current	50 mA	100 mA
Case Temperature, Storage	—	200°C
Continuous RF Input Power	+ 16 dBm	+ 20 dBm
Junction Temperature	150°C	200°C
M.T.T.F. (Projected), Hrs	1×10^6	1×10^4
Thermal Resistance, Θ_{jc} (Junction to Case)	—	130°C/W

TYPICAL POWER SUPPLY CURRENT vs. VOLTAGE

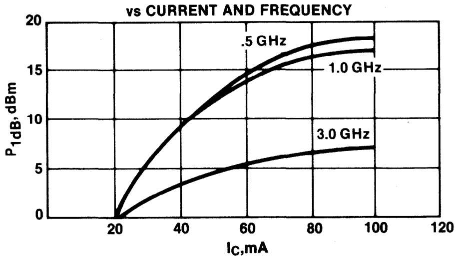


TYPICAL PERFORMANCE CURVES ($T_A = 25°C$), MSA-0470

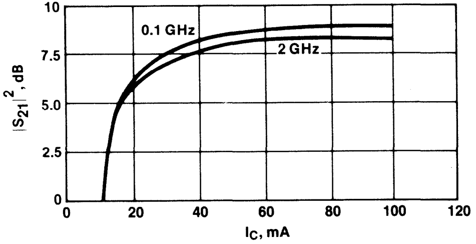
VSWR vs CURRENT FREQUENCY = 1.0 GHz



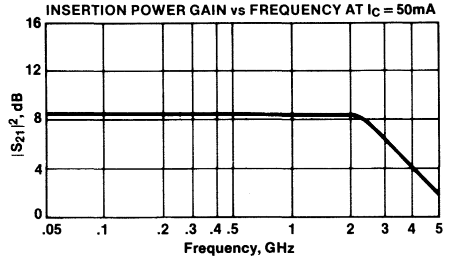
OUTPUT POWER AT 1dB GAIN COMPRESSION vs CURRENT AND FREQUENCY



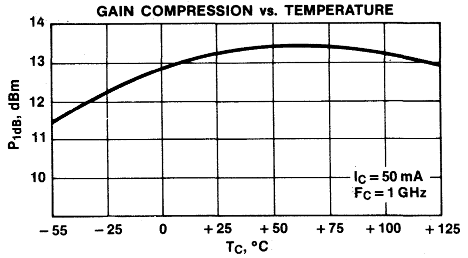
INSERTION POWER GAIN vs CURRENT AND FREQUENCY



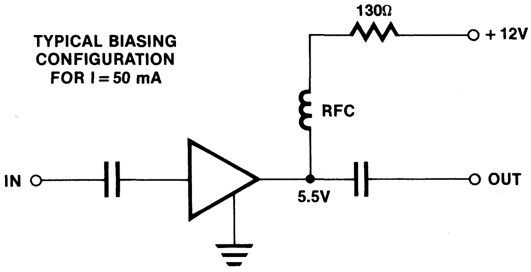
INSERTION POWER GAIN vs FREQUENCY AT $I_C = 50mA$



OUTPUT POWER AT 1dB GAIN COMPRESSION vs. TEMPERATURE



TYPICAL BIASING CONFIGURATION FOR I = 50 mA

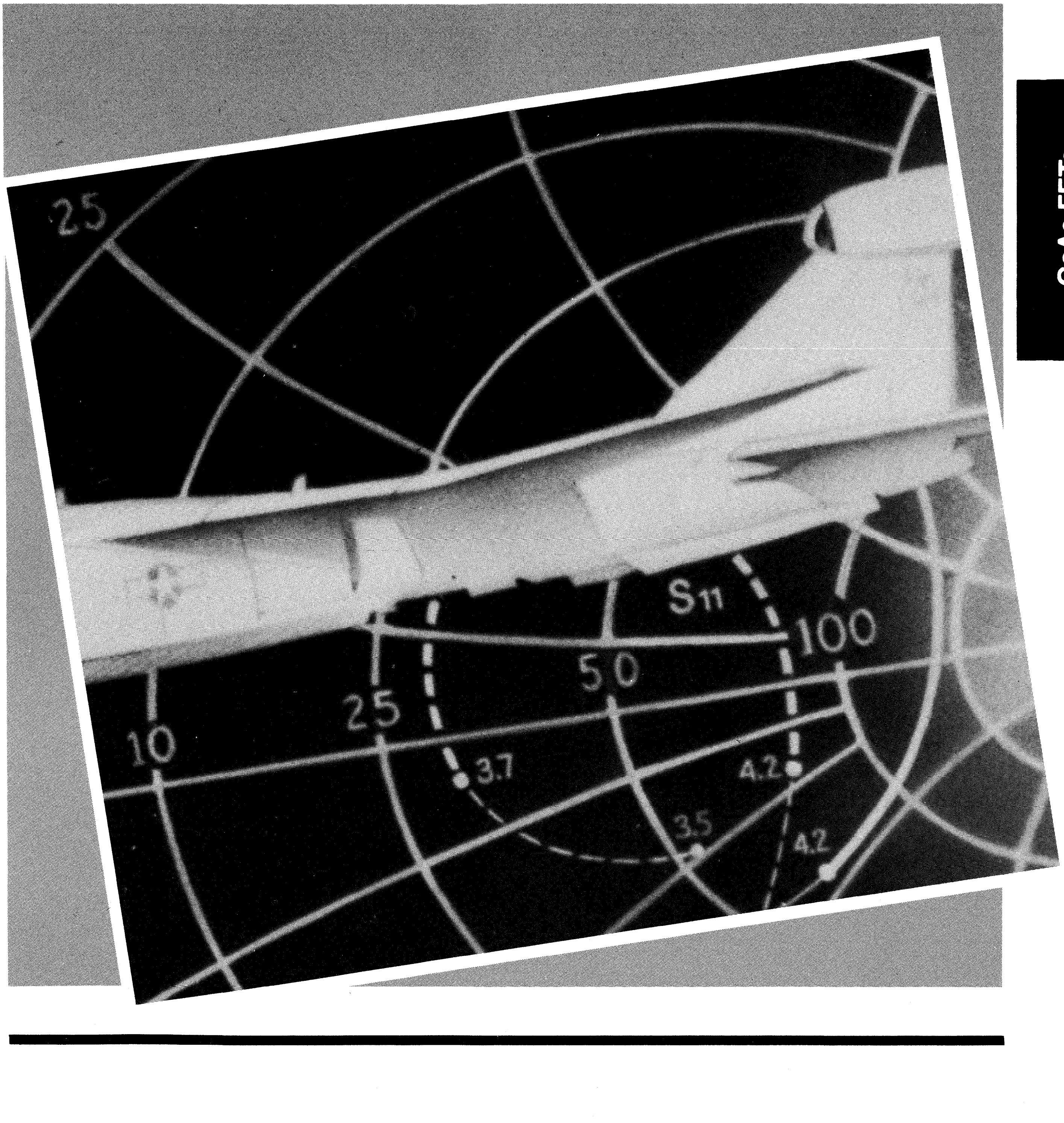


TYPICAL SCATTERING PARAMETERS,* MSA-0470

I = 50 mA (V = 5.5V Typ.)

Freq. MHz	Reflection Coefficient, In S_{11} Mag	Ang	Gain, Forward S_{21} dB	Mag	Ang	Loss, Reverse S_{12} Mag	Ang	Reflection Coefficient, Out S_{22} Mag	Ang
100	.04	− 171.6	8.36	2.62	174.8	.153	.5	.24	− 8.6
500	.05	− 145.6	8.36	2.62	156.9	.154	1.2	.26	− 41.0
1000	.09	− 132.4	8.36	2.62	134.2	.162	1.0	.32	− 76.8
1200	.11	− 132.5	8.36	2.62	125.6	.167	.7	.34	− 88.1
1400	.13	− 134.2	8.31	2.60	116.6	.173	.3	.37	− 99.7
1600	.16	− 137.7	8.24	2.58	107.4	.180	− .6	.39	− 110.0
1800	.19	− 141.6	8.14	2.55	97.6	.189	− 1.4	.42	− 119.6
2000	.21	− 146.3	8.03	2.52	88.0	.196	− 2.7	.44	− 129.0
2200	.24	− 154.4	7.79	2.45	78.3	.203	− 4.1	.45	− 137.4
2400	.27	− 159.3	7.56	2.39	69.4	.209	− 6.4	.46	− 146.2
2600	.30	− 164.0	7.37	2.34	60.8	.214	− 9.1	.46	− 152.4
2800	.33	− 171.9	6.95	2.22	52.6	.222	− 12.4	.47	− 160.2
3000	.36	− 178.4	6.65	2.15	43.9	.229	− 15.5	.47	− 166.2

GaAs FET
Gallium Arsenide
Field Effect Transistors



INTRODUCTION — GALLIUM ARSENIDE FIELD EFFECT TRANSISTORS

Avantek is one of the largest volume manufactures of GaAs FET devices in the world. Avantek's Semiconductor Division can therefore offer a complete line of GaAs Field Effect Transistors suitable for use in all commercial, military and spaceborne applications.

Avantek GaAs FET devices span a full range of product applications and include both low noise and high power devices. Entire device chains can be provided for both low-noise and solid-state power amplifiers suitable for use in ECM and telecommunications applications.

All Avantek GaAs FET devices feature the same level o quality and reliability as those which are screened fo spaceborne applications. All devices utilize refractor gold-metalization eliminating the problems often associated with aluminum metal systems.

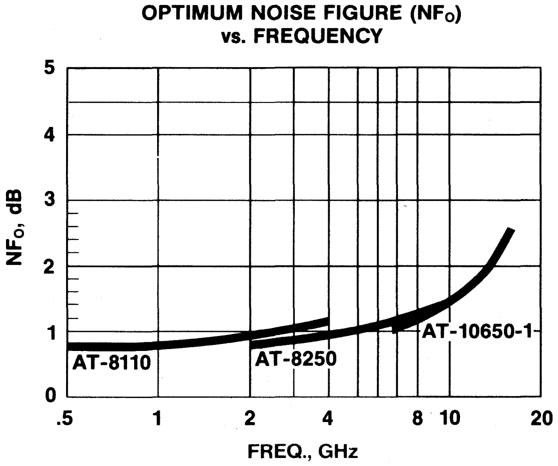
Avantek GaAs FET semiconductor products are available in large quantities at competitive prices. Contac your local Avantek representative for price and delivery

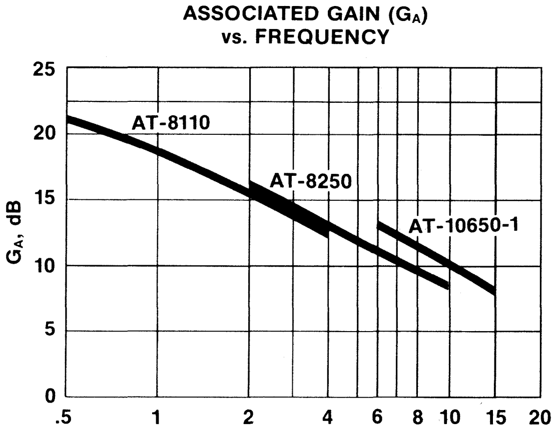
Guaranteed Performance: Small Signal GaAs FETs

Part Number	Optimum Frequency Range Minimum (GHz)	Test Frequency (GHz)	Optimum Noise Figure NFo Typical (dB)	Associated Gain GA Typical (dB)	Maximum Available Gain MAG[1] Typical (dB)	PT Maximum (mW)	Package
AT-8111	2-6	4.0	0.9	12.0	(15.9)[2]	400	chip
AT-8110	2-6	4.0	1.1	12.0	15.9	400	70 mil
AT-8251	2-12	4.0	0.9	13.0	(16.0)[2]	400	chip
AT-8250	2-8	4.0	0.9	12.5	(17.0)[2]	400	70 mil
AT-12570-5	2-12	4.0	1.2	12.0	(16.9)[2]	400	70 mil
AT-12535	2-12	4.0	1.2	12.5	(16.2)[2]	400	micro-X
AT-10600	4-18	12.0	1.8	9.0	12.5	200	chip
AT-10650-1	4-15	12.0	1.8	9.0	10.5	200	50 mil
AT-10650-3	4-15	12.0	2.3	8.0	10.5	200	50 mil
AT-10650-5	4-15	12.0	2.5	8.0	11.7	200	50 mil

Notes 1: MAG (MSG) calculated at power bias.
2: (MSG), Maximum Stable Gain; -k 1

TYPICAL PERFORMANCE: LOW NOISE GaAs FETs



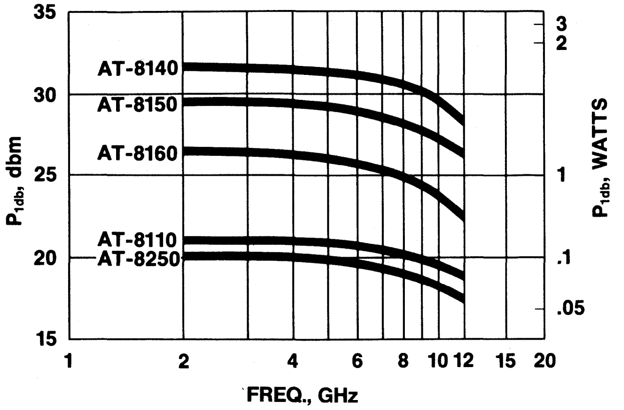


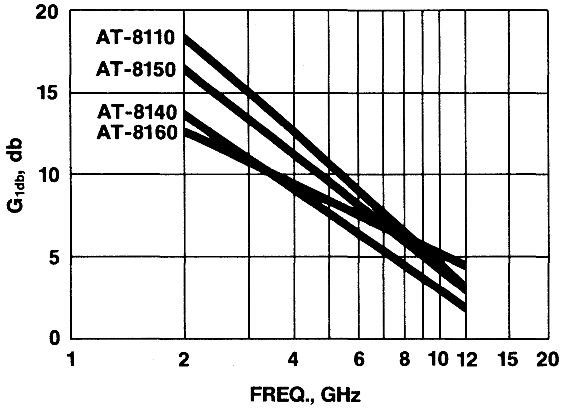
MEDIUM POWER GaAs FETs

Part Number	Optimum Frequency Range Minimum (GHz)	Test Frequency (GHz)	Output Power at 1 dB Gain Comp. P1dB Typical (dB)	1 dB Gain Comp. Point G1dB Typical (dB)	Maximum Available Gain MAG[1] Typical (dB)	PT Maximum (W)	Package
AT-8161	2-15	4.0	26.0	12.0	(17.0)[2]	2.4	chip
AT-8160	2-10	4.0	26.0	11.0	(15.9)[2]	2.4	100 mil flange
AT-11671	2-14	4.0	26.0	12.0	(16.5)[2]	2.4	70 mil flange
AT-8151	2-15	4.0	29.0	12.0	14.9	4.0	chip
AT-8150	2-10	4.0	29.0	11.0	12.8	4.0	100 mil flange
AT-11571	2-14	4.0	29.0	12.0	15.6	4.0	70 mil flange
AT-8141	2-10	4.0	32.0	9.0	12.8	7.0	chip
AT-8140	208	4.0	31.5	9.0	12.2	7.0	100 mil flange

Notes 1: MAG (MSG) calculated at power bias.
2: (MSG), Maximum Stable Gain; -k 1

YPICAL PERFORMANCE: LINEAR POWER GaAs FETs


OUTPUT POWER @ 1db COMPRESSION GAIN (P_{1db}) vs. FREQUENCY


TYPICAL PERFORMANCE: MED POWER GaAs FETS
1db COMPRESSED GAIN vs. FREQUENCY

ECOMMENDED GaAs FETs FOR CLASS-A AMPLIFIER APPLICATIONS

requency	Low Noise Amplifier Stages	Intermediate Amplifier Stages	Driver/Output Amplifier Stages
GHz	AT-8110/8250 AT-12535	AT-8110/8160/12570-5	AT-8150/8140
GHz	AT-8110/8250 AT-12535	AT-8110/8160/12570-5	AT-8150/8140
GHz	AT-10650-1 AT-8250	AT-8160	AT-8150
2 GHz	AT-10650-1 AT-8250, 8251	AT-11671	AT-11571
3 GHz			AT-10650-3

AT-8110
2-6 GHz Low Noise Med. Power Gallium Arsenide FET

FEATURES

- **1.1 dB NF, 12 dB G_A @ 4 GHz**
- **+20 dBm Linear Po @ 4 GHz**
- **All Gold-based Metallization**
- **Hermetic 70 mil Package**
- **Very Wide Dynamic Range**

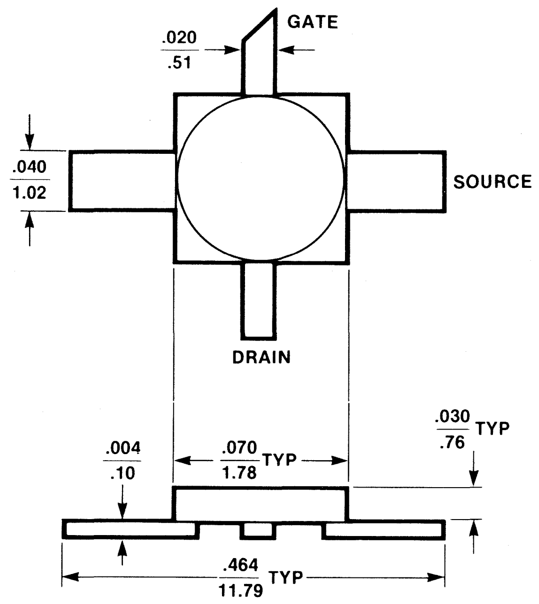
DESCRIPTION

The AT-8110 is a gallium arsenide Schottky-gate field effect transistor, particularly designed for low noise, medium output power, and very wide dynamic range in the 2 to 6 GHz frequency region. It is ideal for narrow band communication and radar amplifiers as well as for wide band EW applications.

This unique GaAs FET combines a half-micron gate length for low noise figure with a 28 gate geometry that provides input resonance at 4 GHz. The input impedance is easy to match to for both noise figure and gain/power.

In addition to its very good input characteristics, the AT-8110 features 1.1 dB noise figure at 4 GHz with 12 dB associated gain and +20 dBm output power at 1 dB gain compression point. The addition of high power capability to a low noise figure transistor permits an extremely wide dynamic range amplifier design.

AVANTEK 70 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 3V$, $I_{DS} = 20$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Spot Noise Figure	4 GHz 6	dB		1.1 1.5	1.3
G_A	Gain at Optimum Noise Figure	4 GHz 6	dB	11	12 9	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		+20	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$ ($I_{DS} = I_{DSS}$)		mmho	50	100	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	80	110	200
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2	−4
BV_{GD}	Breakdown Voltage, Gate to Drain: $I_{GD} = 100\ \mu A$		V	−4.0		

RECOMMENDED MAXIMUM RATINGS

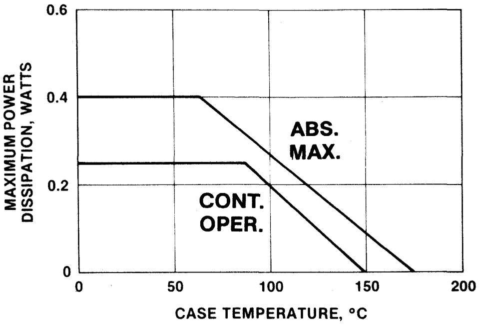
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 200° C/W (T_{CH} = 60° C)

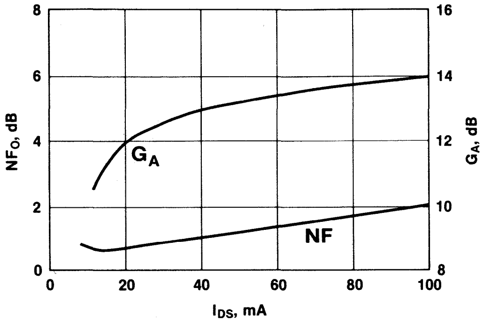
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

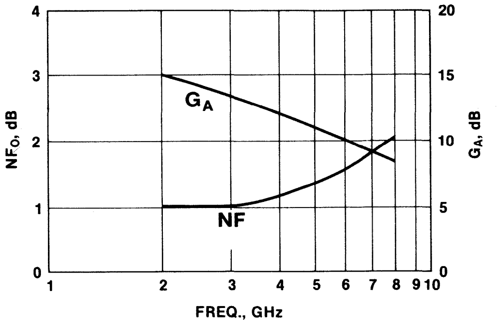
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. I_{DS} AT V_{DS} = 3V, FREQUENCY = 4 GHz



SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. FREQUENCY V_{DS} = 3V, I_{DS} = 20 mA



TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

V_{DS} = 3V, I_{DS} = 20 mA

Freq.	S11		S21			S12			S22	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.92	-30	14.8	5.48	153	-30.2	.031	60	.51	-23
1.0	.87	-56	14.1	5.07	134	-25.7	.052	48	.46	-40
1.5	.83	-80	13.2	4.57	117	-23.2	.069	36	.41	-56
2.0	.79	-102	12.2	4.06	100	-21.9	.080	24	.37	-71
2.5	.77	-122	11.2	3.64	86	-21.2	.087	14	.34	-85
3.0	.75	-140	10.2	3.24	71	-20.7	.092	5	.32	-99
3.5	.73	-155	9.3	2.92	58	-20.4	.095	-2	.30	-110
4.0	.72	-168	8.5	2.66	47	-20.4	.095	-8	.29	-120
4.5	.72	178	7.7	2.41	35	-20.3	.097	-14	.28	-132
5.0	.71	167	7.0	2.22	24	-20.2	.098	-19	.28	-144
5.5	.71	156	6.3	2.05	14	-20.2	.098	-23	.29	-156
6.0	.71	147	5.6	1.89	5	-20.0	.100	-28	.31	-167
6.5	.70	138	5.0	1.77	-4	-19.9	.101	-32	.33	-177
7.0	.70	131	4.4	1.66	-13	-19.8	.102	-36	.35	175
7.5	.70	123	4.0	1.57	-22	-19.7	.104	-39	.38	168
8.0	.68	117	3.5	1.50	-31	-19.4	.107	-43	.39	164

V_{DS} = 5V, I_{DS} = 50 mA

Freq.	S11		S21			S12			S22	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.91	-33	16.7	6.82	151	-32.8	.023	57	.57	-21
1.0	.86	-61	15.8	6.19	131	-28.6	.037	46	.51	-34
1.5	.82	-87	14.8	5.48	113	-26.4	.048	35	.46	-47
2.0	.78	-110	13.6	4.77	96	-25.2	.055	26	.42	-58
2.5	.76	-130	12.5	4.22	82	-24.6	.059	-17	.35	-69
3.0	.75	-147	11.4	3.72	68	-24.2	.062	11	.37	-81
3.5	.73	-162	10.4	3.32	54	-23.9	.064	5	.36	-90
4.0	.72	-175	9.6	3.02	43	-23.9	.064	1	.34	-99
4.5	.72	172	8.7	2.72	32	-23.6	.066	-2	.33	-109
5.0	.71	161	8.0	2.50	21	-23.3	.068	-5	.33	-121
5.5	.71	150	7.3	2.30	10	-23.1	.070	-7	.34	-132
6.0	.71	141	6.5	2.12	1	-22.9	.072	-11	.35	-145
6.5	.71	133	5.9	1.98	-7	-22.4	.076	-13	.37	-155
7.0	.71	125	5.4	1.85	-17	-22.0	.079	-16	.40	-164
7.5	.70	118	4.9	1.75	-26	-21.5	.084	-19	.42	-173
8.0	.69	111	4.4	1.65	-35	-21.0	.089	-22	.45	-179

AT-8111
2-6 GHz Ultra Low Noise Medium Power Gallium Arsenide FET

FEATURES

- **0.9 dB NF, 12 dB G_A @ 4 GHz**
- **1.3 dB NF, 10 dB G_A @ 6 GHz**
- **+21 dBm Linear $P_{1\ dB}$ @ 4 GHz**
- **All Gold-based Metallization**
- **Very Wide Dynamic Range**
- **Chip Form**

DESCRIPTION

The AT-8111 is a gallium arsenide Schottky-gate field effect transistor, particularly designed for simplified input matching, low noise figure, medium power, and wide dynamic range in 2-6 GHz frequency range.

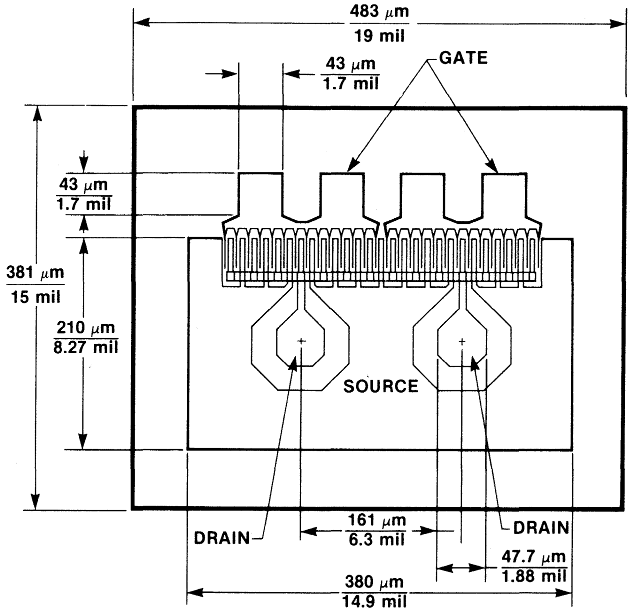
This AT-811 is an unpackaged 15 x 9 mil chip usable in thin film and thick film hybrid circuits. Its gold and refractory metal system provides excellent bond strength and assures compatibility with the wire bonding techniques used in hybrid fabrication.

This unique GaAs FET combines a half-micron gate length with a 28 gate geometry utilizing air bridge cross-overs that minimize both gate resistance and chip size.

The addition of high power capability to a low noise figure transistor permits an extremely wide dynamic range amplifier design.

The AT-8111, like all Avantek transistors, features a metal system that combines gold and refractory metals throughout. Even the gate is gold metalized. This minimizes the corrosion, intermetallic growth and burnout problems associated with some other metal systems used in GaAs FET fabrication—thus helping to assure excellent long term reliability.

AVANTEK 110 CHIP



ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 3V$, $I_{DS} = 20$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Spot Noise Figure	4 GHz 6	dB		0.9 1.3	
G_A	Gain at Optimum Noise Figure	4 GHz 6	dB		12 10	
$P_{1\ dB}$	Output Power at 1 dB Gain Compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		+21	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$ ($I_{DS} = I_{DSS}$)		mmho	50	100	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	80	110	200
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	– 0.8	– 2	– 4
BV_{GD}	Breakdown Voltage — Gate-to-Drain: $I_{GD} = 100$ µA		V	– 4.0		

RECOMMENDED MAXIMUM RATINGS

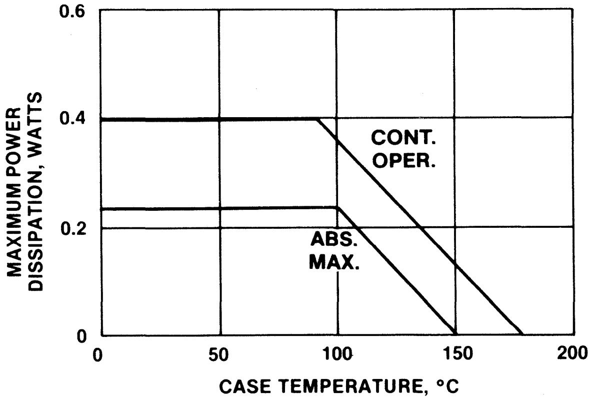
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 150° C/W (T_{CH} = 60° C)

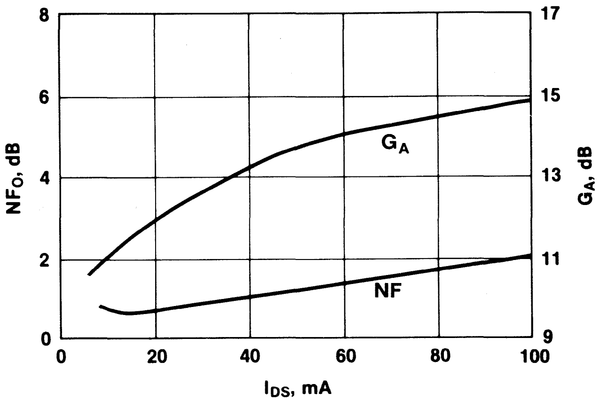
Notes:

1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

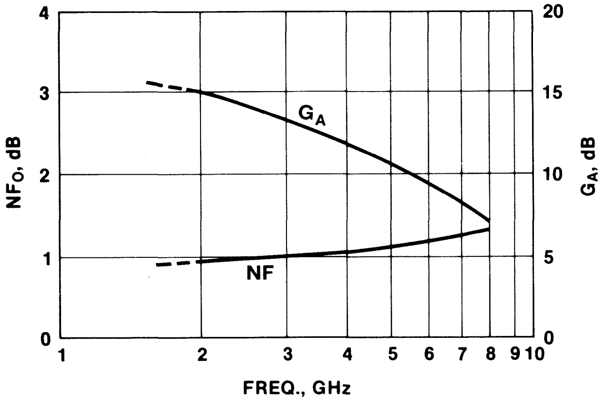
MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



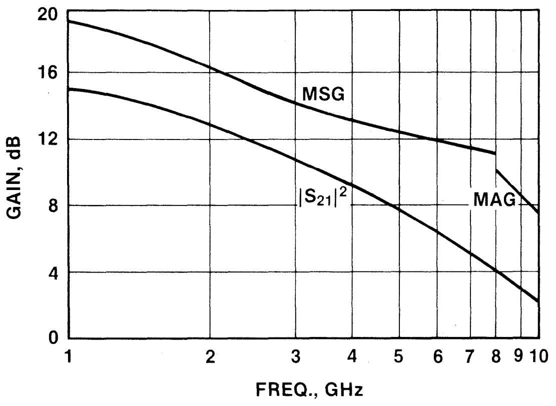
SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. I_{DS} AT V_{DS} = 3V, FREQUENCY = 4 GHz



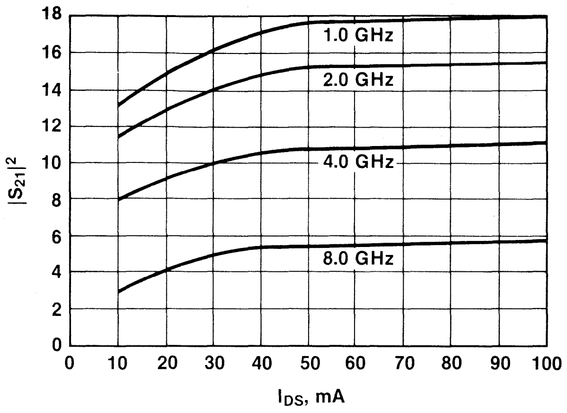
SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. FREQUENCY V_{DS} = 3V, I_{DS} = 20 mA



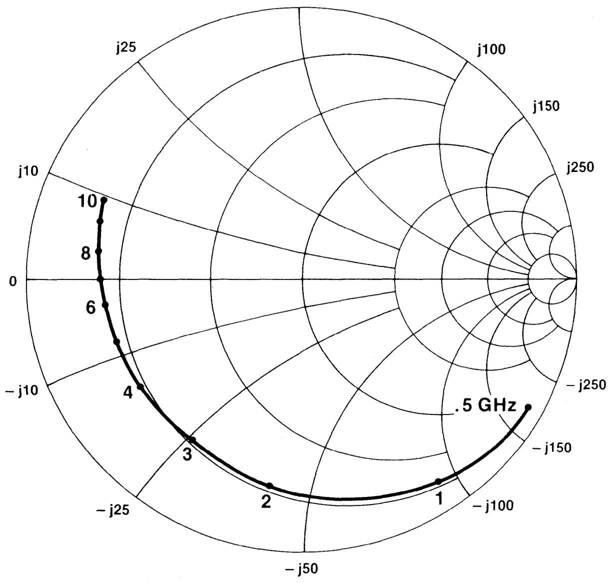
INSERTION POWER GAIN, $|S_{21}|^2$, MAXIMUM STABLE GAIN, MSG, AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY
$V_{DS} = 3V$, $I_{DS} = 20$ mA



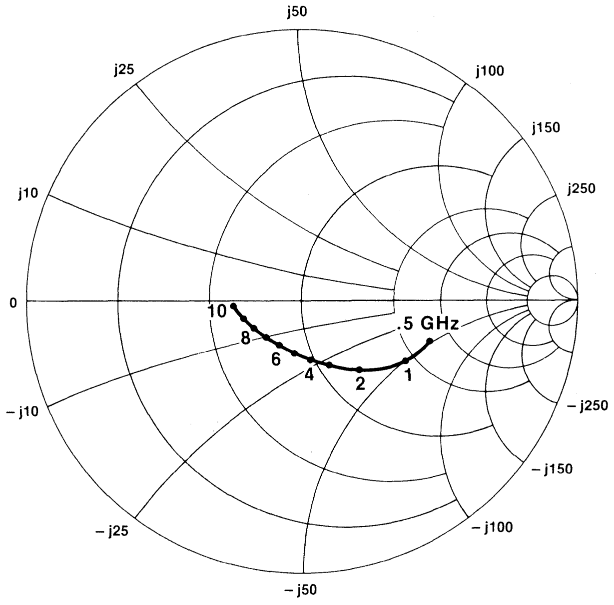
INSERTION POWER GAIN, $|S_{21}|^2$, vs. DRAIN CURRENT & FREQUENCY
$V_{DS} = 3V$



INPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 5V$, $I_{DS} = 50$ mA



OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 5V$, $I_{DS} = 50$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

V_{DS} = 3V, I_{DS} = 20 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.97	– 26	15.5	5.98	160	– 28.9	.036	75	.48	– 17
1.0	.94	– 48	15.0	5.60	144	– 23.6	.066	64	.44	– 33
2.0	.83	– 89	12.9	4.44	116	– 19.7	.104	46	.34	– 63
3.0	.76	– 115	10.8	3.48	97	– 18.3	.122	35	.27	– 85
4.0	.74	– 137	9.0	2.83	82	– 17.8	.129	27	.23	– 106
5.0	.73	– 154	7.5	2.37	70	– 17.6	.132	23	.21	– 125
6.0	.72	– 168	6.2	2.04	58	– 17.6	.132	20	.21	– 145
7.0	.72	– 176	5.1	1.80	48	– 17.7	.131	19	.23	– 160
8.0	.74	175	4.0	1.59	38	– 17.6	.132	19	.25	– 173
9.0	.76	166	3.0	1.41	28	– 17.4	.135	19	.27	174
10.0	.76	161	2.0	1.26	21	– 17.1	.140	18	.30	165

V_{DS} = 5V, I_{DS} = 50 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.95	– 30	18.5	8.46	158	– 31.4	.027	71	.49	– 17
1.0	.90	– 56	17.7	7.67	139	– 26.4	.048	61	.44	– 30
2.0	.79	– 100	15.2	5.73	112	– 22.9	.072	47	.33	– 53
3.0	.74	– 125	12.7	4.33	93	– 21.6	.083	40	.25	– 69
4.0	.73	– 145	10.8	3.48	80	– 21.0	.089	37	.21	– 83
5.0	.72	– 161	9.2	2.89	68	– 20.5	.094	36	.18	– 98
6.0	.72	– 173	7.9	2.47	57	– 20.2	.098	36	.17	– 117
7.0	.72	179	6.8	2.17	48	– 19.7	.103	37	.18	– 134
8.0	.74	172	5.7	1.92	37	– 19.2	.110	39	.20	– 149
9.0	.77	163	4.6	1.70	28	– 18.5	.119	39	.22	– 163
10.0	.78	158	3.6	1.52	21	– 17.8	.129	38	.25	– 175

AT-8140
One Watt, 2-8 GHz
Gallium Arsenide FET

FEATURES

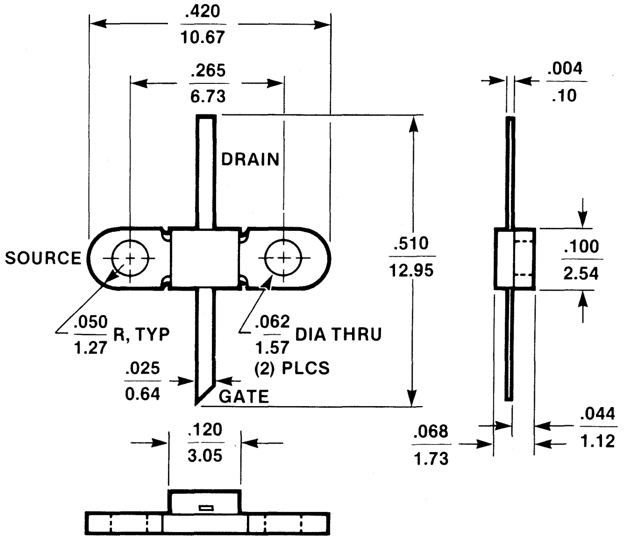
- **+31 dBm Min. Power Output ($P_{1\ dB}$) @ 4 GHz**
- **8 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Hermetic Copper-Flange Stripline Package**

DESCRIPTION

The Avantek® AT-8140 is a gallium arsenide Schottky-gate field effect transistor designed for medium power, linear amplification in the 2 to 8 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET incorporates a chip (available in unpackaged form as the AT-8141) with a four-cell, 5-millimeter gate periphery structure with airbridge interconnects between source pads. It is supplied in the Avantek 100 mil FET flange package—a rugged, hermetic package with low parasitic reactance and minimum thermal resistance.

AVANTEK 100 MIL FET FLANGE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$

2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Min.	Typ.	Max.
$P_{1\ dB}$	Output Power at 1 dB Gain Compression, $V_{DS} = 9V$, $I_{DS} = 500$ mA	4 GHz 8	dBm	31.0	31.5 30.0	
$G_{1\ dB}$	1 dB Compressed Gain: $V_{DS} = 9V$, $I_{DS} = 500$ mA	4 GHz 8	dB	8.0	9.0 4.0	
MAG	Maximum Available Gain, $V_{DS} = 9V$, $I_{DS} = 500$ mA	8 GHz	dB		6	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	300	450	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	800	1100	1500
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage, Gate-to-drain: $I_{GD} = 1$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

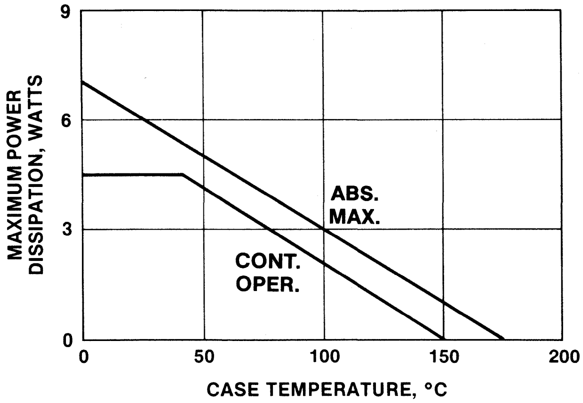
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	4.5 W	7.0 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 23° C/W (T_{CH} = 60° C)

Notes:

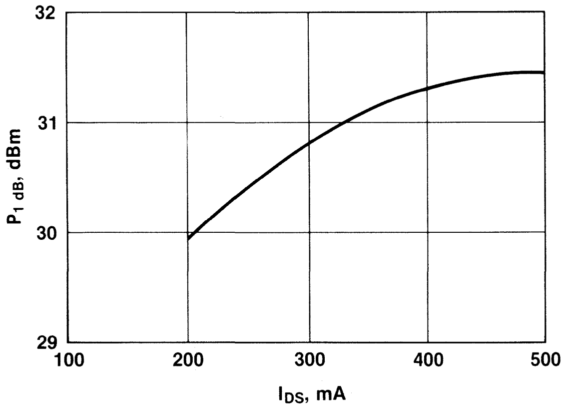
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

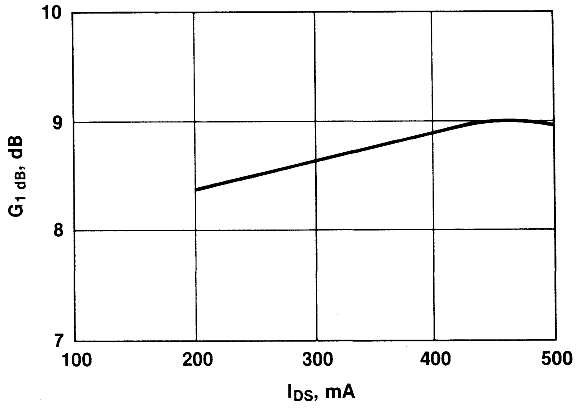


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

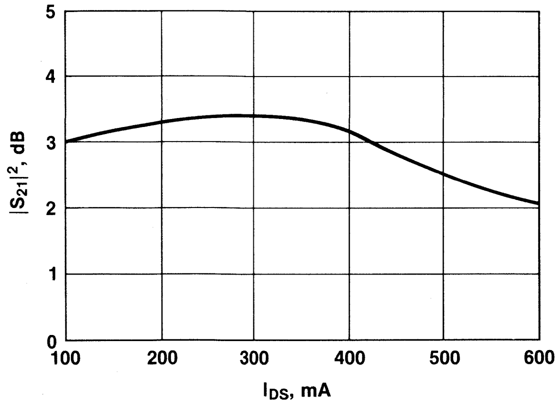
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz V_{DS} = 9V



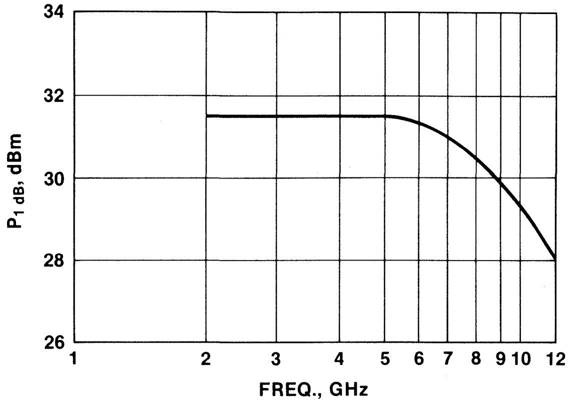
1 dB COMPRESSION GAIN ($G_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz



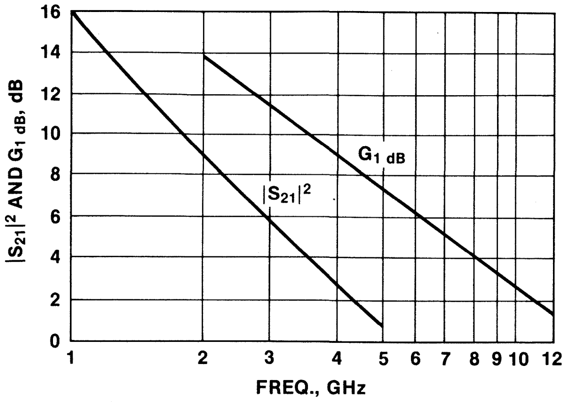
INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS}
FREQUENCY = 4.0 GHz, V_{DS} = 9V



POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 500$ mA



1 dB COMPRESSED GAIN ($G_{1\,dB}$) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 500$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 6V$, $I_{DS} = 500$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.86	− 140	13.5	4.75	100	− 29.6	.033	38	.41	− 166
2.0	.86	− 158	8.4	2.63	82	− 27.7	.041	45	.43	− 165
3.0	.84	− 166	5.5	1.87	70	− 25.7	.052	54	.43	− 163
4.0	.86	− 174	3.0	1.41	57	− 23.0	.071	58	.44	− 163
5.0	.81	171	1.0	1.12	42	− 20.5	.094	52	.44	− 167
6.0	.83	151	− 0.3	.96	26	− 18.9	.113	46	.45	− 175
7.0	.85	133	− 0.7	.91	9	− 18.0	.126	42	.51	168
8.0	.88	127	− 3.4	.67	− 2	− 17.5	.134	37	.59	155
9.0	.89	129	− 5.5	.53	− 4	− 16.4	.151	39	.66	152
10.0	.87	134	− 6.1	.49	− 2	− 13.8	.205	39	.68	152
11.0	.79	127	− 4.7	.58	− 2	− 9.0	.355	26	.61	145
12.0	.44	128	− 2.1	.78	− 23	− 4.8	.573	− 24	.34	147
13.0	.65	123	− 3.1	.70	− 51	− 9.6	.330	− 78	.47	160

$V_{DS} = 9V$, $I_{DS} = 500$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.85	− 139	13.8	4.92	98	− 29.9	.032	36	.30	− 156
2.0	.86	− 157	8.6	2.69	79	− 28.2	.039	43	.34	− 152
3.0	.84	− 165	5.5	1.89	66	− 26.4	.048	53	.37	− 149
4.0	.86	− 174	3.9	1.56	52	− 23.9	.064	61	.41	− 147
5.0	.82	171	2.3	1.30	36	− 21.0	.089	55	.42	− 152
6.0	.84	151	1.1	1.13	20	− 19.3	.108	49	.44	− 161
7.0	.86	133	− 0.9	.89	2	− 18.1	.124	45	.51	− 179
8.0	.88	127	− 3.7	.65	− 10	− 17.5	.134	38	.59	164
9.0	.89	129	− 6.0	.50	− 12	− 16.4	.152	37	.67	158
10.0	.86	134	− 6.7	.46	− 10	− 14.0	.199	33	.68	158
11.0	.77	132	− 5.5	.52	− 12	− 10.6	.294	16	.60	155
12.0	.62	130	− 3.9	.63	− 29	− 9.0	.354	− 20	.49	159
13.0	.66	113	− 3.9	.63	− 53	− 11.5	.266	− 54	.52	156

AT-8141
One Watt, 2-10 GHz Gallium Arsenide FET Chip

FEATURES

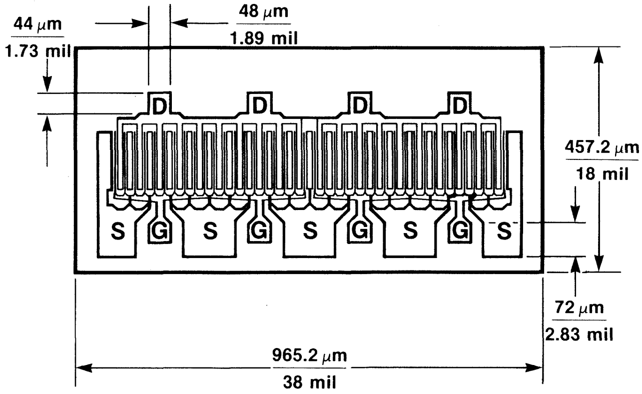
- **+31 dBm Min. Power Output ($P_{1\,dB}$) @ 4 GHz**
- **8 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Suitable for Broadband Applications**
- **Optimum Thermal and Electrical Design**
- **Large Bonding Pads**

DESCRIPTION

The Avantek® AT-8141 is an unpackaged gallium arsenide Schottky-gate field effect transistor chip designed for medium power, linear amplification in the 2 to 10 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET chip (also available in packaged form as the AT-8140) has a four-cell, 5-millimeter gate periphery structure with airbridge interconnects between source pads. All metal surfaces are gold plate for ease of bonding and die attach. Large bonding pads facilitate bonding into hybrid integrated circuits.

AVANTEK M114 CHIP



ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 500$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	4 GHz 8	dBm		32.0 31.0	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz 8	dB		9.0 6.0	
MAG	Maximum Available Gain	8 GHz	dB		8.0	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	300	450	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	800	1100	1500
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage, Gate to Drain: $I_{GD} = 1$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

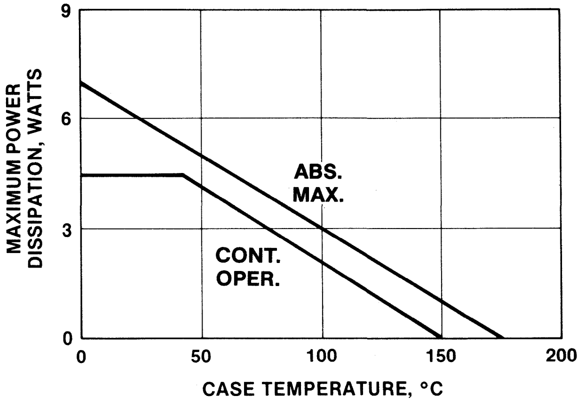
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+16V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation	P_T	4.5 W	7.0 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 18° C/W (T_{CH} = 60° C)

Notes:

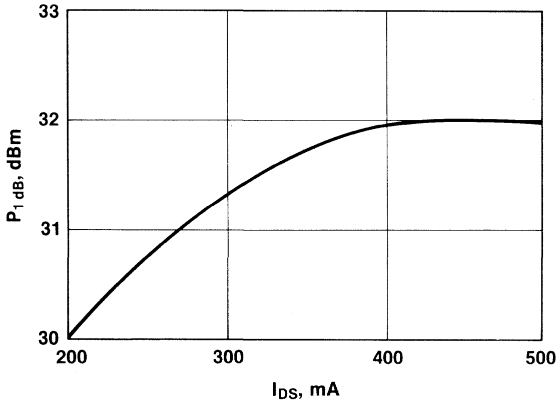
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

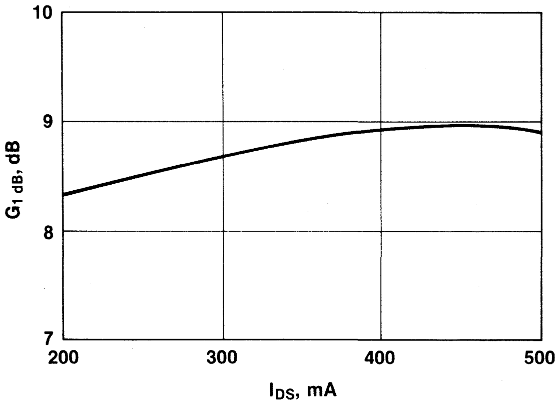


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

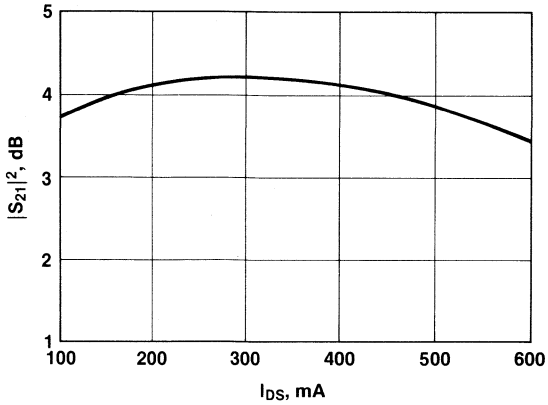
POWER OUTPUT AT 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz, V_{DS} = 9V

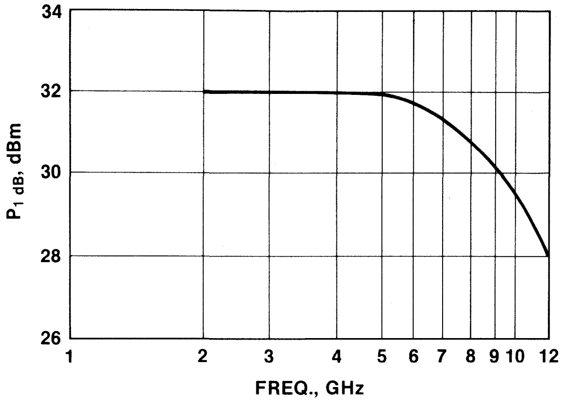


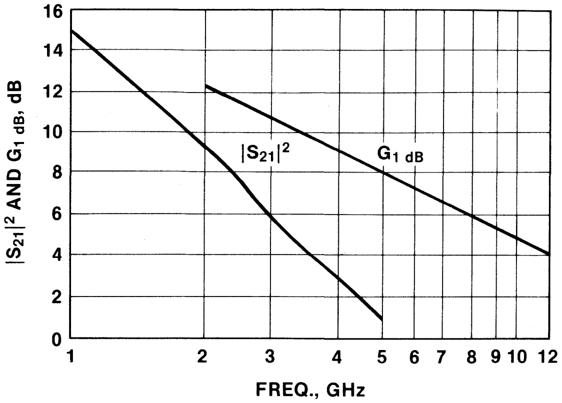
1 dB COMPRESSED GAIN ($G_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz, V_{DS} = 9V



INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} FREQUENCY = 4.0 GHz, V_{DS} = 9V




POWER OUTPUT AT 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 500$ mA


1 dB COMPRESSED GAIN ($G_{1\,dB}$) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 500$ mA

TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 9V$, $I_{DS} = 500$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.87	-91	14.9	5.56	101	-31.1	.028	40	.22	-52
2.0	.84	-136	9.3	2.93	83	-29.4	.034	49	.18	-83
3.0	.84	-157	5.5	1.89	73	-28.0	.040	61	.20	-97
4.0	.85	-168	3.2	1.44	66	-26.6	.047	72	.22	-106
5.0	.85	-174	1.0	1.12	58	-25.0	.056	80	.25	-111
6.0	.88	-179	-0.7	.92	52	-23.7	.065	84	.28	-115
7.0	.84	-179	-2.3	.76	49	-22.6	.074	90	.32	-123
8.0	.83	172	-3.2	.69	45	-21.3	.086	92	.34	-127
9.0	.85	160	-4.2	.61	42	-20.3	.097	94	.38	-137
10.0	.83	145	-4.8	.57	36	-19.1	.111	95	.39	-148
11.0	.77	129	-5.5	.53	30	-17.8	.129	92	.43	-160
12.0	.84	116	-6.1	.49	21	-17.3	.137	84	.48	-177
13.0	.79	108	-7.9	.40	15	-17.3	.136	81	.52	157

AT-8150
0.5 Watt, 2–10 GHz
Gallium Arsenide FET

FEATURES

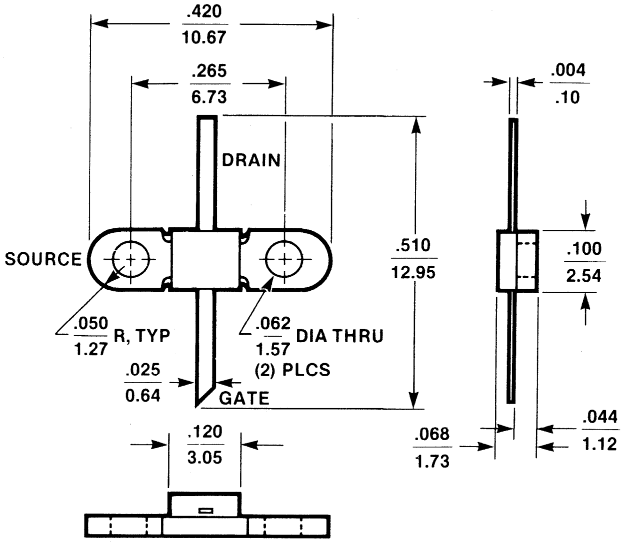
- **+28 dBm Min. Power Output ($P_{1\,dB}$) @ 4 GHz**
- **9.0 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Hermetic Copper-Flange Stripline Package**

DESCRIPTION

The Avantek® AT-8150 is a gallium arsenide Schottky-gate field effect transistor designed for medium power, linear amplification in the 2 to 10 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET incorporates a chip (available in unpackaged form as the AT-8151) with a four-cell, 5-millimeter gate periphery structure with airbridge interconnects between drain pads. It is supplied in the Avantek 100 mil FET flange package—a rugged, hermetic package with low parasitic reactance and minimum thermal resistance.

AVANTEK 100 MIL FET FLANGE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 250$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	4 GHz 8	dBm	28.0	29.0 28.0	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz 8	dB	9.0	11.0 6.0	
MAG	Maximum Available Gain	8 GHz	dB		8.5	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	150	225	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	400	600	800
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage — Gate-to-Drain: $I_{GD} = 1.0$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

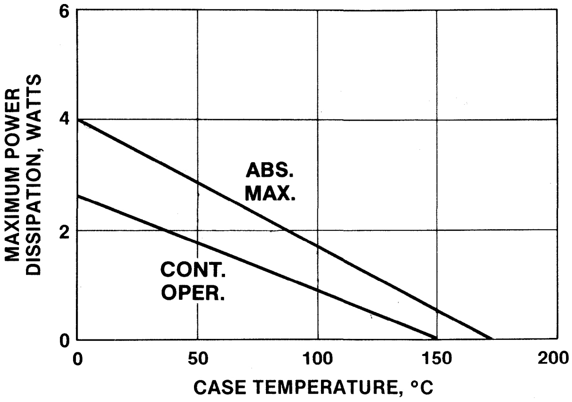
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	2.7 W	4.0 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 35° C/W (T_{CH} = 60° C)

Notes:

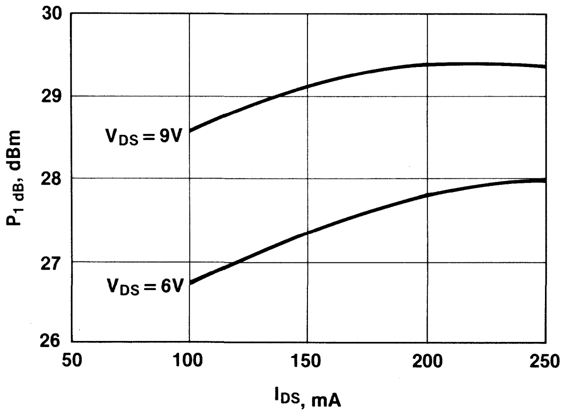
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

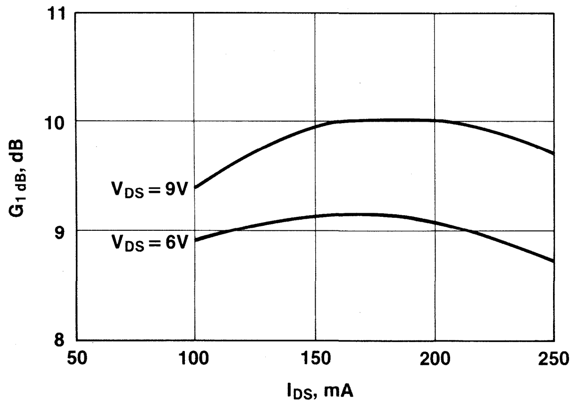


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

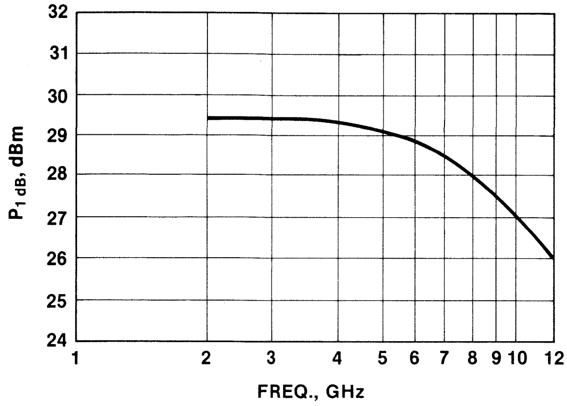
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0, 8 GHz



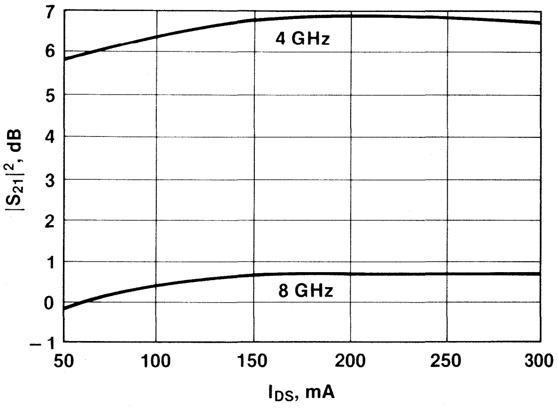
1 dB COMPRESSION GAIN ($G_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



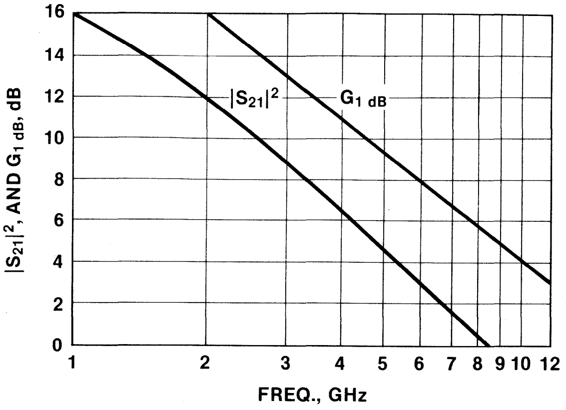
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. FREQUENCY V_{DS} = 9V, I_{DS} = 250 mA



INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS}
FREQUENCY = 4.0 GHz



1 dB COMPRESSED GAIN ($G_{1\,dB}$) AND
INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
V_{DS} = 9V, I_{DS} = 250 mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

V_{DS} = 9V, I_{DS} = 250 mA

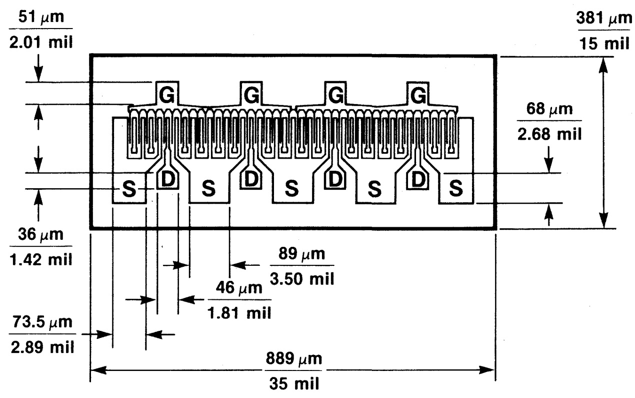
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.81	-96	15.5	5.98	115	-29.6	.033	46	.21	-83
2.0	.78	-129	11.3	3.67	89	-27.5	.042	49	.27	-100
3.0	.75	-143	8.4	2.62	71	-26.0	.050	63	.32	-107
4.0	.74	-154	6.7	2.17	57	-22.7	.073	75	.37	-113
5.0	.69	-171	5.4	1.86	40	-18.1	.124	79	.41	-123
6.0	.71	164	4.4	1.66	21	-15.9	.160	67	.43	-141
7.0	.77	137	2.5	1.33	0	-14.9	.180	52	.52	-167
8.0	.83	125	-0.5	.94	-16	-14.5	.188	32	.61	164
9.0	.86	124	-3.3	.68	-23	-14.5	.189	39	.70	158
10.0	.85	127	-4.7	.58	-24	-12.7	.233	40	.75	156
11.0	.82	123	-5.4	.53	-26	-10.1	.314	37	.76	150
12.0	.79	108	-5.5	.53	-33	-6.9	.452	22	.76	133
13.0	.78	81	-6.3	.48	-42	-5.0	.561	-1	.83	103

AT-8151
0.5 Watt, 2-15 GHz
Gallium Arsenide FET
Chip

FEATURES

- **+28 dBm Min. Power Output ($P_{1\ dB}$) @ 4 GHz**
- **9 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Suitable for Broadband Applications**
- **Optimum Thermal and Electrical Design**
- **Large Bonding Pads**

AVANTEK M115 CHIP



DESCRIPTION

The Avantek® AT-8151 is an unpackaged gallium arsenide Schottky-gate field effect transistor chip designed for medium power, linear amplification in the 2 to 15 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET chip (also available in packaged form as the AT-8150) has a four-cell, 2.5-millimeter gate periphery structure with airbridge interconnects between drain pads. All metal surfaces are gold plated for ease of bonding and die attach. Large bonding pads facilitate bonding into hybrid integrated circuits.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 250$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\ dB}$	Output Power at 1 dB Gain Compression	4 GHz	dBm		29.0	
		8			28.0	
		12			27.0	
$G_{1\ dB}$	1 dB Compressed Gain	4 GHz	dB		12.0	
		8			8.0	
		12			6.0	
MAG	Maximum Available Gain	8 GHz	dB		9.5	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	150	225	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	400	600	800
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage, Gate-to-Drain: $I_{GD} = 1$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

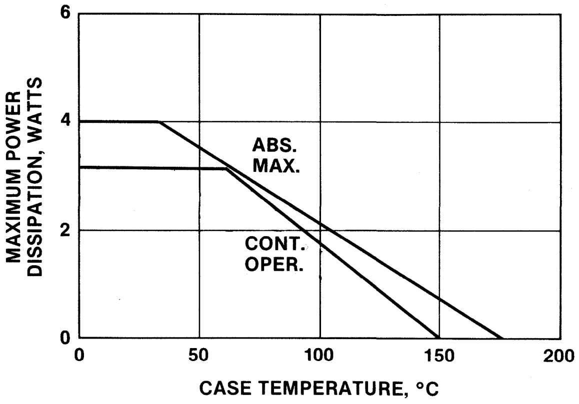
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation	P_T	2.7 W	4.0 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 27° C/W (T_{CH} = 60° C)

Notes:

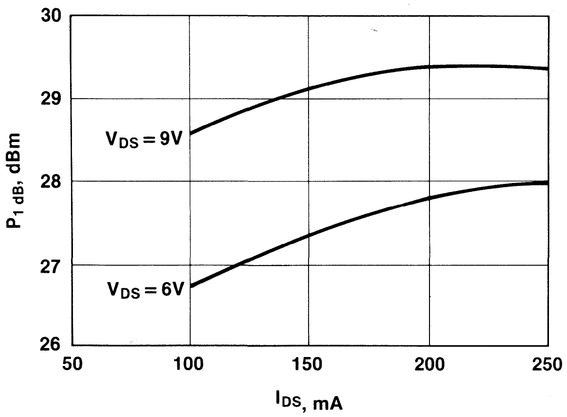
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

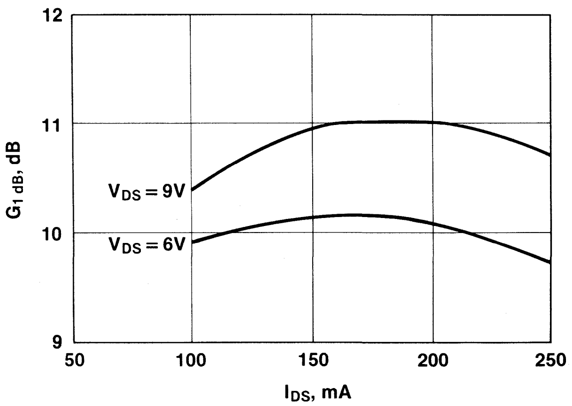


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

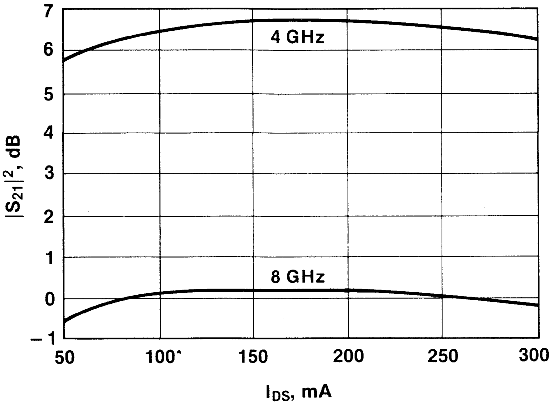
POWER OUTPUT AT 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



1 dB COMPRESSED GAIN ($G_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz

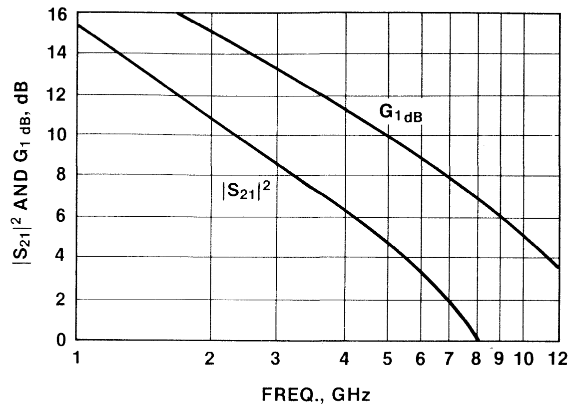


INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} FREQUENCY = 4.0 GHz, 8.0 GHz, $V_{DS} = 9V$



1 dB COMPRESSED GAIN ($G_{1\,dB}$) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 250$ mA

POWER OUTPUT AT 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 250$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 6V$, $I_{DS} = 250$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.86	−101	17.3	7.31	120	−29.1	.035	43	.18	−106
2.0	.84	−133	12.8	4.34	97	−28.0	.040	40	.22	−124
3.0	.84	−146	9.4	2.96	85	−27.5	.042	45	.27	−129
4.0	.84	−153	7.2	2.27	76	−26.9	.045	55	.32	−132
5.0	.84	−157	5.1	1.80	69	−26.6	.047	65	.37	−134
6.0	.86	−161	3.6	1.50	61	−25.5	.053	71	.44	−135
7.0	.86	−161	2.0	1.25	57	−24.6	.059	79	.49	−133
8.0	.87	−163	1.0	1.11	51	−23.3	.068	83	.54	−130
9.0	.87	−164	0.1	1.00	45	−22.4	.076	85	.57	−131
10.0	.87	−167	−0.9	.90	39	−21.5	.084	86	.58	−135
11.0	.88	−170	−1.8	.81	33	−20.8	.091	84	.60	−142
12.0	.89	−174	−2.7	.73	25	−20.4	.095	81	.63	−150

$V_{DS} = 9V$, $I_{DS} = 250$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.86	−101	17.4	7.37	118	−29.9	.032	42	.21	−66
2.0	.84	−133	12.7	4.34	95	−28.9	.036	39	.22	−88
3.0	.84	−146	9.4	2.94	82	−28.6	.037	46	.27	−100
4.0	.85	−153	7.1	2.26	72	−28.2	.039	59	.33	−108
5.0	.85	−157	5.0	1.78	64	−27.7	.041	71	.38	−114
6.0	.87	−161	3.4	1.47	56	−26.2	.049	79	.46	−119
7.0	.87	−162	1.7	1.21	50	−25.0	.056	87	.52	−120
8.0	.88	−163	0.6	1.06	44	−23.6	.066	91	.58	−120
9.0	.88	−165	−0.4	.95	38	−22.4	.076	93	.62	−121
10.0	.88	−167	−1.4	.84	31	−21.4	.085	94	.64	−126
11.0	.89	−170	−2.4	.76	25	−20.5	.094	91	.65	−133
12.0	.90	−174	−3.3	.68	16	−20.1	.099	87	.69	−142

AT-8160
0.25 Watt, 2–10 GHz
Gallium Arsenide FET

FEATURES

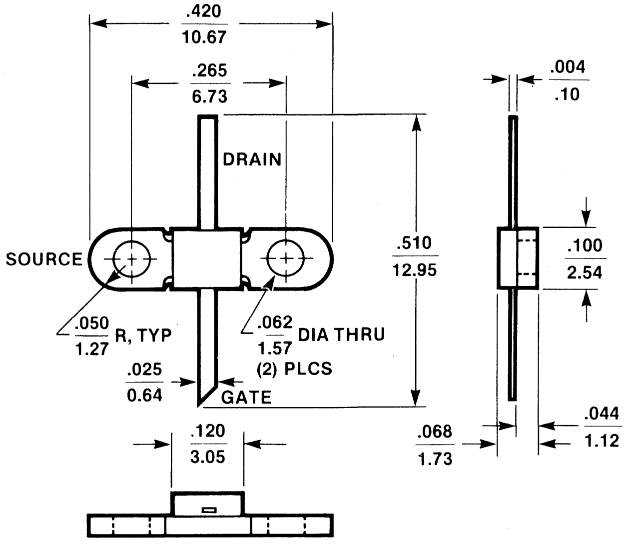
- **+25 dBm Min. Power Output ($P_{1\,dB}$) @ 4 GHz**
- **10 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Hermetic Copper-Flange Stripline Package**

DESCRIPTION

The Avantek® AT-8160 is a gallium arsenide Schottky-gate field effect transistor designed for medium power, linear amplification in the 2 to 10 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET incorporates a chip (available in unpackaged form as the AT-8161) with a two-cell, 1.25-millimeter gate periphery structure with airbridge interconnects between drain pads. It is supplied in the Avantek 100 mil FET flange package—a rugged, hermetic package with low parasitic reactance and minimum thermal resistance.

AVANTEK 100 MIL FET FLANGE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{IN}{MM}$

2. TOLERANCES: $\frac{XXX}{XX} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 125$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power at 1 dB Gain Compression	4 GHz 8	dBm	25.0	26.0 24.5	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz 8	dB	10.0	11.0 7.5	
MAG	Maximum Available Gain	8 GHz	dB		9.5	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	60	120	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	200	300	450
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage — Gate-to-Drain: $I_{GD} = 1.0$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

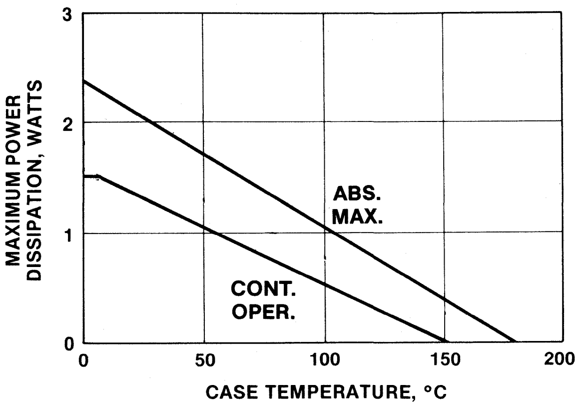
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	−5V	−7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	1.6 W	2.4 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 70° C/W (T_{CH} = 60° C)

Notes:

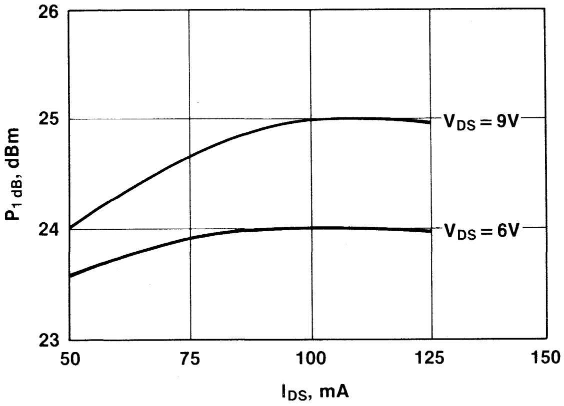
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE} = 25° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

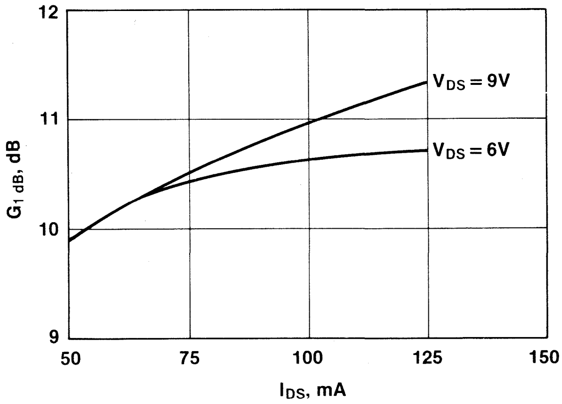


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

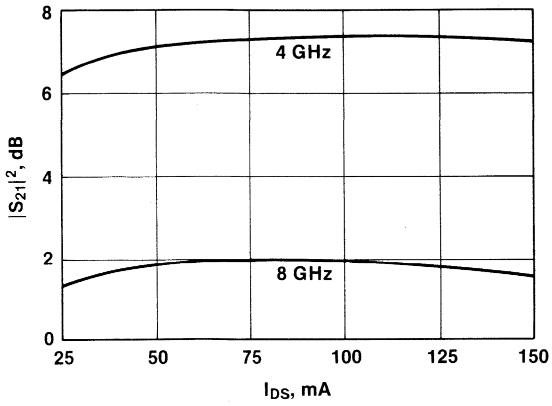
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



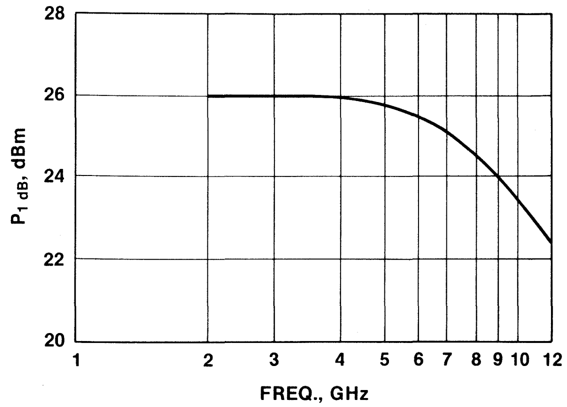
1 dB COMPRESSION GAIN ($G_{1\,dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



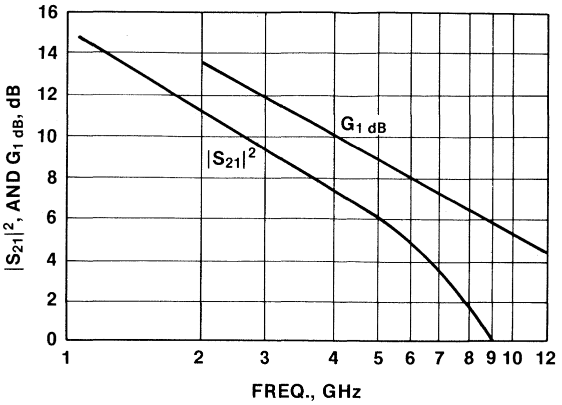
INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} FREQUENCY = 4.0, 8.0 GHz, V_{DS} = 9V



POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\ dB}$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 125$ mA



1 dB COMPRESSED GAIN ($G_{1\ dB}$) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 125$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 6V$, $I_{DS} = 125$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.87	– 72	15.3	5.79	129	– 26.9	.045	48	.39	– 45
2.0	.80	– 108	12.0	3.98	102	– 24.7	.058	35	.38	– 66
3.0	.77	– 128	9.5	2.97	84	– 23.7	.065	29	.39	– 77
4.0	.75	– 140	7.9	2.48	71	– 23.1	.070	32	.42	– 83
5.0	.70	– 156	6.6	2.14	56	– 22.9	.072	27	.43	– 92
6.0	.69	– 178	6.0	2.00	40	– 21.9	.080	28	.42	– 100
7.0	.70	154	4.8	1.74	21	– 21.5	.084	26	.38	– 118
8.0	.76	139	3.0	1.41	4	– 21.2	.087	20	.39	– 145
9.0	.78	136	1.0	1.12	– 6	– 21.1	.088	20	.47	– 161
10.0	.76	139	0.0	1.00	– 13	– 21.3	.086	21	.55	– 164
11.0	.74	135	0.0	1.00	– 20	– 19.3	.109	23	.59	– 163
12.0	.67	116	0.5	1.05	– 35	– 17.1	.140	15	.59	– 166
13.0	.65	84	0.5	1.05	– 54	– 15.5	.168	1	.60	– 177

$V_{DS} = 9V$, $I_{DS} = 125$ mA

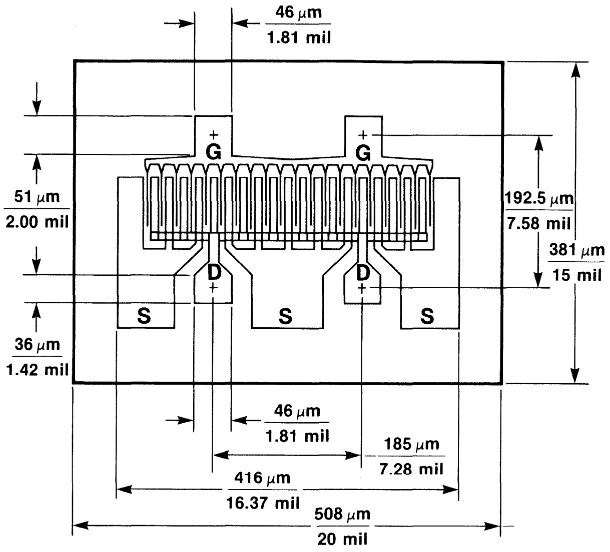
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.88	– 72	14.8	5.52	127	– 27.7	.041	48	.50	– 35
2.0	.81	– 109	11.5	3.77	99	– 25.8	.051	34	.47	– 54
3.0	.78	– 128	8.9	2.78	81	– 25.0	.056	28	.49	– 65
4.0	.77	– 141	7.3	2.32	67	– 24.6	.059	35	.52	– 73
5.0	.72	– 158	6.0	1.99	52	– 24.6	.059	33	.52	– 82
6.0	.70	179	5.4	1.85	35	– 23.6	.066	37	.52	– 90
7.0	.72	153	4.2	1.62	16	– 22.6	.074	38	.49	– 104
8.0	.78	138	2.4	1.32	– 1	– 21.9	.080	31	.48	– 130
9.0	.80	135	0.3	1.03	– 14	– 21.3	.086	31	.55	– 149
10.0	.78	138	– 0.7	.91	– 21	– 21.4	.085	33	.63	– 155
11.0	.76	133	– 0.9	.90	– 29	– 19.0	.112	34	.68	– 157
12.0	.69	113	– 0.6	.93	– 44	– 16.7	.146	24	.69	– 161
13.0	.67	80	– 0.7	.92	– 63	– 14.9	.180	9	.71	– 171

AT-8161
0.25 Watt, 2-15 GHz Gallium Arsenide FET Chip

FEATURES

- **+25 dBm Min. Power Output ($P_{1\,dB}$) @ 4 GHz**
- **10 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization**
- **Optimized Power Epitaxy and Doping**
- **Suitable for Broadband Applications**
- **Optimum Thermal and Electrical Design**
- **Large Bonding Pads**

AVANTEK M116 Chip



DESCRIPTION

The Avantek® AT-8161 is a gallium arsenide Schottky-gate field effect transistor chip designed for medium power, linear amplification in the 2 to 15 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET chip (also available in packaged form as the AT-8160) has a two-cell, 1.25-millimeter gate periphery structure with airbridge interconnects between drain pads. All metal surfaces are gold-plated for ease of bonding and die attach. Large bonding pads facilitate bonding into hybrid integrated circuits.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 125$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power at 1 dB Gain Compression,	4 GHz 8 12	dBm		26.0 25.5 24.5	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz 8 12	dB		12.0 9.0 6.0	
MAG	Maximum Available Gain	8 GHz	dB		10.5	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	60	120	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	200	300	450
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	−2.0	-3.5	−5.4
BV_{GD}	Breakdown Voltage — Gate-to-Drain: $I_{GD} = 1$ mA		V	-12	−16	

RECOMMENDED MAXIMUM RATINGS

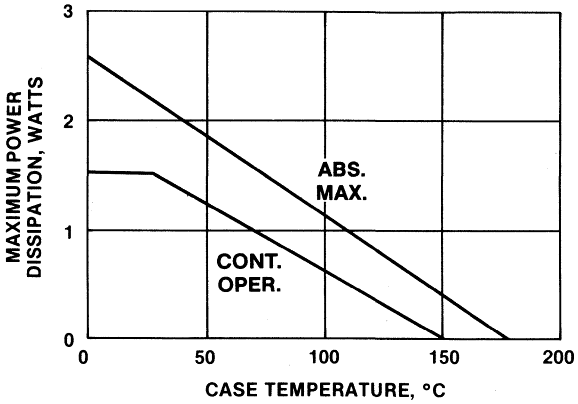
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation	P_T	1.6 W	2.4 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 66° C/W (T_{CH} = 60° C)

Notes:

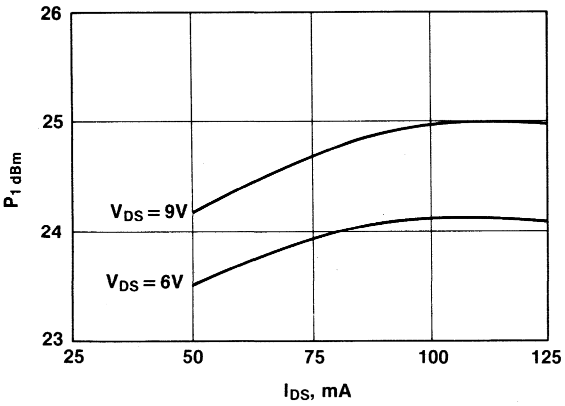
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

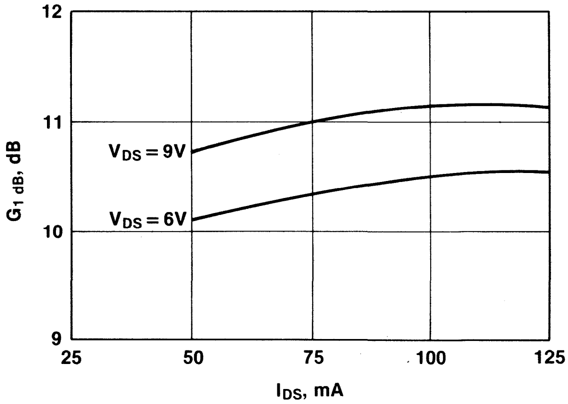


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

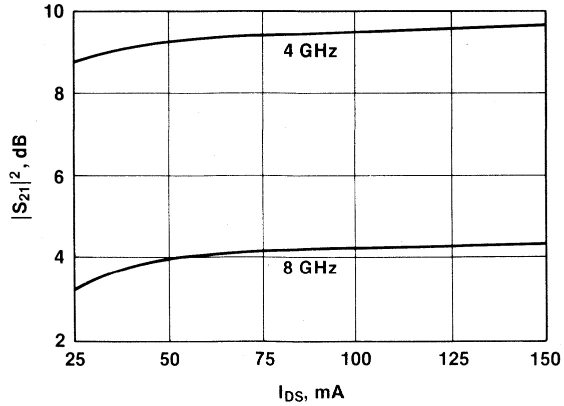
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz

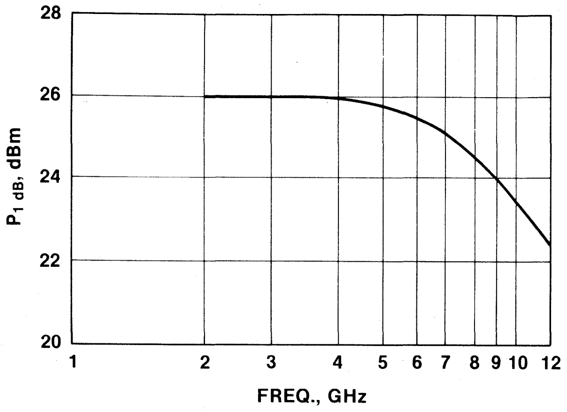


1 dB COMPRESSION GAIN ($G_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz

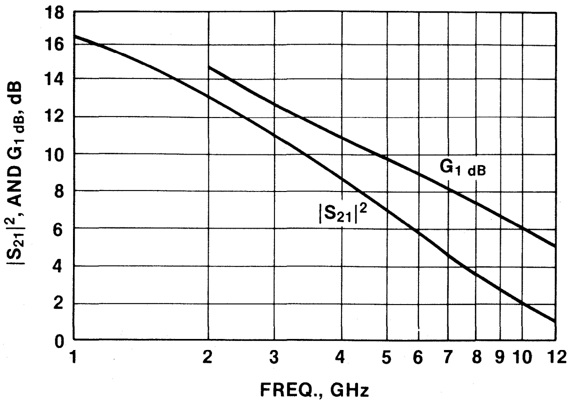


1 dB COMPRESSED GAIN ($G_{1\,dB}$) AND INSERTION POWER GAIN ($|S_{21}|^2$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 125$ mA





POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 125$ mA



INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS}
Freq. = 4.0, 8.0 GHz, $V_{DS} = 9V$

TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 6V$, $I_{DS} = 125$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.90	−58	16.2	6.48	140	−29.9	.032	59	.50	−19
2.0	.82	−96	13.6	4.79	115	−26.9	.045	48	.44	−30
3.0	.79	−121	11.1	3.59	97	−26.2	.049	44	.41	−38
4.0	.78	−138	9.3	2.91	85	−26.0	.050	48	.39	−44
5.0	.77	−149	7.6	2.39	74	−26.0	.050	55	.38	−52
6.0	.80	−159	6.3	2.07	65	−25.4	.054	62	.38	−62
7.0	.79	−164	5.1	1.78	57	−24.6	.059	70	.38	−73
8.0	.80	−171	4.2	1.62	47	−23.3	.068	74	.40	−83
9.0	.81	−179	3.4	1.48	37	−22.0	.079	74	.42	−95
10.0	.82	170	2.4	1.31	26	−21.3	.086	73	.43	−110
11.0	.84	161	1.2	1.15	15	−20.5	.094	69	.46	−127
12.0	.86	155	−0.2	.97	4	−20.4	.096	64	.51	−143

$V_{DS} = 9V$, $I_{DS} = 125$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.89	−58	16.0	6.30	139	−29.1	.035	58	.48	−29
2.0	.81	−95	13.3	4.63	115	−26.2	.049	49	.42	−46
3.0	.78	−118	10.8	3.48	98	−25.4	.054	47	.39	−60
4.0	.77	−133	9.0	2.82	87	−25.0	.056	52	.37	−72
5.0	.75	−143	7.2	2.30	77	−24.9	.057	59	.36	−84
6.0	.78	−152	5.9	1.96	67	−24.0	.063	65	.35	−95
7.0	.77	−156	4.5	1.67	61	−23.2	.069	73	.38	−102
8.0	.79	−160	3.6	1.51	53	−22.0	.079	78	.43	−103
9.0	.78	−166	2.8	1.38	46	−20.9	.090	79	.45	−107
10.0	.78	−173	1.9	1.24	37	−20.0	.100	80	.46	−115
11.0	.81	−178	1.0	1.12	30	−19.0	.112	78	.46	−126
12.0	.83	177	0.3	1.03	21	−18.2	.123	74	.48	−139

AT-8250
2-8 GHz Low Noise
Med. Power
Gallium Arsenide FET

FEATURES

- **0.9 dB NF, 12 dB G_A @ 4 GHz**
- **1.4 dB NF, 10 dB G_A @ 6 GHz**
- **+20 dBm Linear Po @ 4 GHz**
- **All Gold-based Metallization**
- **Hermetic 70 mil Package**
- **Very Wide Dynamic Range**

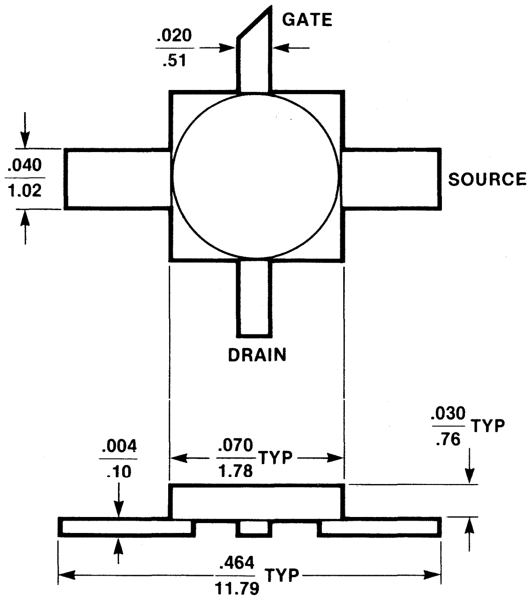
DESCRIPTION

The AT-8250 is a gallium arsenide Schottky-gate field effect transistor, particularly designed for low noise, medium output power, and very wide dynamic range in the 2 to 8 GHz frequency region. It is ideal for narrow band communication and radar amplifiers as well as for wide band EW applications.

This unique GaAs FET combines a half-micron gate length for low noise figure with a 14 gate geometry that provides input resonance at 6 GHz. The input impedance is easy to match to for both noise figure and gain/power.

In addition to its very good input characteristics, the AT-8250 features 0.9 dB noise figure at 4 GHz with 12 dB associated gain and +20 dBm output power at 1 dB gain compression point. The addition of high power capability to a low noise figure transistor permits an extremely wide dynamic range amplifier design.

AVANTEK 70 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 3V$, $I_{DS} = 20$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Spot Noise Figure	4 GHz	dB		0.9	1.0
		6			1.4	
G_A	Gain at Optimum Noise Figure	4 GHz	dB	11	12.5	
		6			10	
NF_∞	N.F. of Infinite Cascade of AT-8250s	4 GHz	dB		1.0	
		6			1.5	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		+20	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$ ($I_{DS} = I_{DSS}$)		mmho	25	45	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	50	110	150
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2	−4
BV_{GD}	Breakdown Voltage, Gate to Drain: $I_{GD} = 100\ \mu A$		V	−4.0		

RECOMMENDED MAXIMUM RATINGS

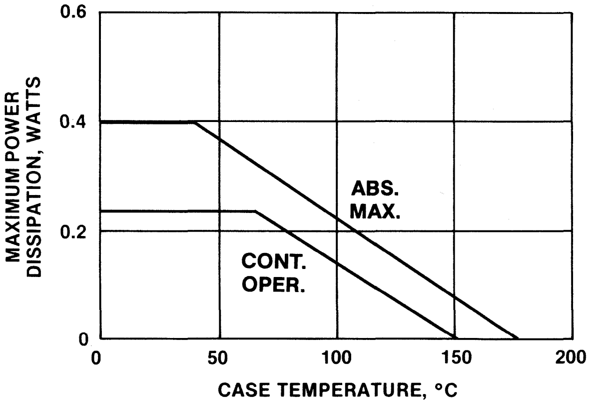
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 250°C/W (T_{CH} = 60°C)

Notes:

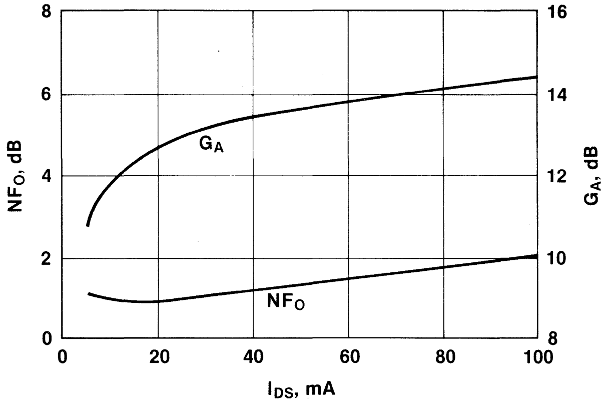
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

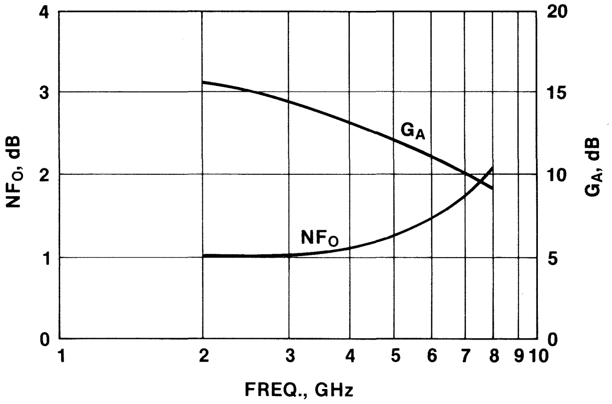


TYPICAL PERFORMANCE CURVES, T_A = 25°C

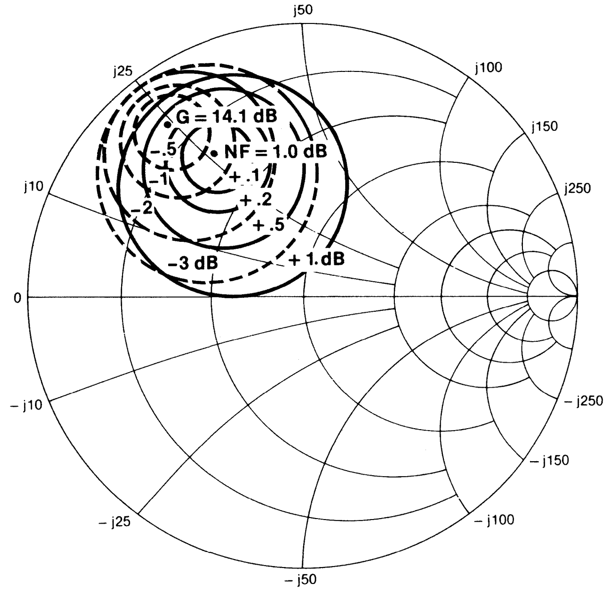
SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. I_{DS} AT V_{DS} = 3V, FREQUENCY = 4 GHz



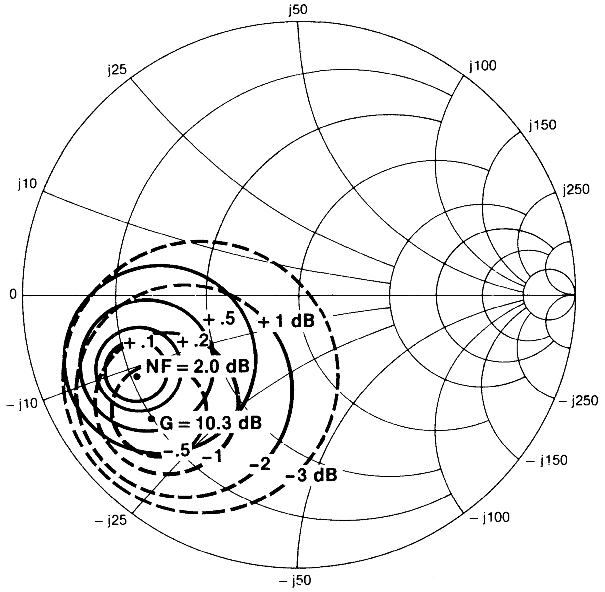
SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. FREQUENCY V_{DS} = 3V, I_{DS} = 20 mA



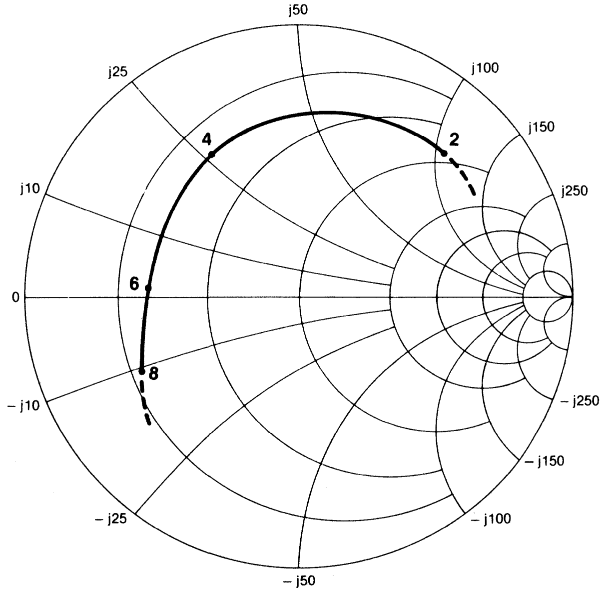
CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE
FREQUENCY = 4 GHz, V_{DS} = 3V, I_{DS} = 20 mA
G = 14.1 dB, NF = 1.0 dB



CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE
FREQUENCY = 8 GHz, V_{DS} = 3V, I_{DS} = 20 mA
G = 10.3 dB, NF = 2.0 dB



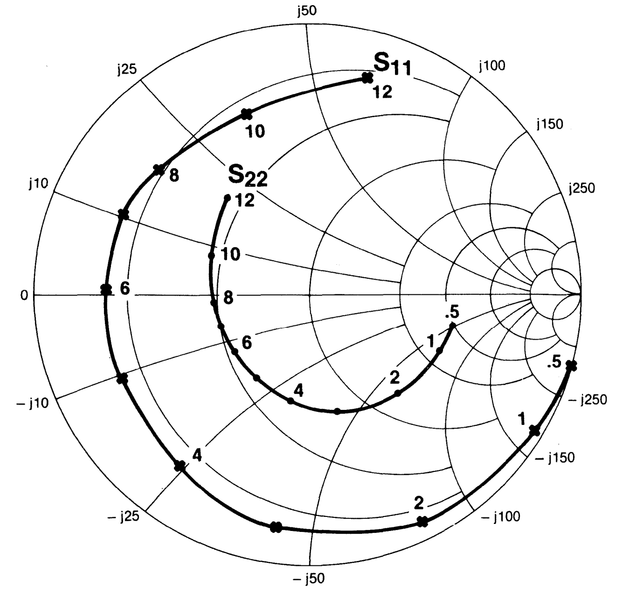
OPTIMUM SOURCE IMPEDANCE vs FREQUENCY
V_{DS} = 3V, I_{DS} = 20 mA



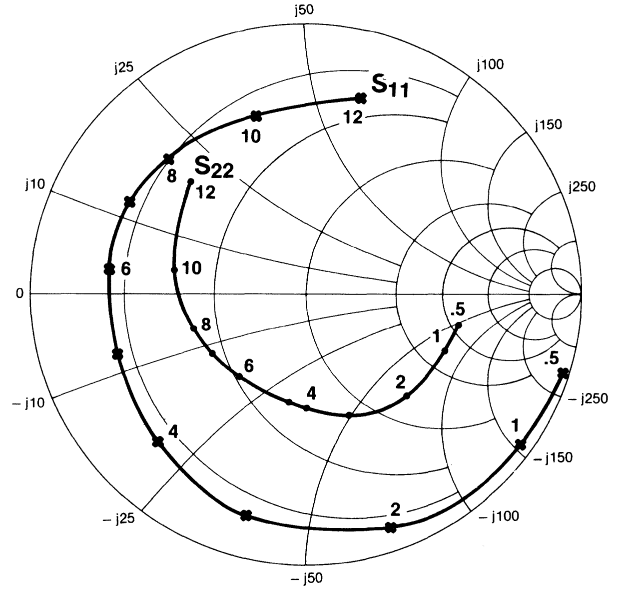
NOISE PARAMETERS vs. FREQUENCY
V_{DS} = 3V, I_{DS} = 20 mA

Freq. GHz	F_{min} & dB	G_{NF} dB	$F_{50\,\Omega}$ dB	Γ_o Mag	Ang	R_N Ω
2.0	1.01	15.8	2.47	.74	45	29.9
4.0	1.03	12.9	2.15	.60	121	9.6
6.0	1.52	10.9	2.87	.55	177	4.4
8.0	2.02	9.0	3.77	.65	– 154	5.9

INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 3V$, $I_{DS} = 20$ mA



INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 5V$, $I_{DS} = 50$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 3.0V$, $I_{DS} = 20.0$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.98	– 16	12.2	4.08	164	– 34.9	.018	78	.52	– 12
1.0	.96	– 32	12.1	4.02	150	– 28.9	.036	68	.51	– 23
2.0	.92	– 64	11.9	3.91	121	– 23.3	.068	45	.48	– 49
3.0	.86	– 98	11.2	3.61	93	– 20.6	.093	23	.43	– 75
4.0	.78	– 126	10.1	3.19	66	– 19.5	.106	3	.38	– 97
5.0	.74	– 155	9.1	2.84	41	– 18.8	.115	– 14	.35	– 119
6.0	.71	179	8.1	2.54	20	– 18.6	.117	– 29	.33	– 140
7.0	.72	156	7.1	2.27	– 1	– 18.6	.118	– 43	.33	– 159
8.0	.69	139	6.1	2.02	– 21	– 18.7	.116	– 57	.34	– 174
10.0	.68	107	4.7	1.72	– 59	– 16.9	.114	– 81	.38	153
12.0	.81	74	3.9	1.56	– 102	– 18.9	.113	– 110	.45	127

$V_{DS} = 5.0V$, $I_{DS} = 50.0$ mA

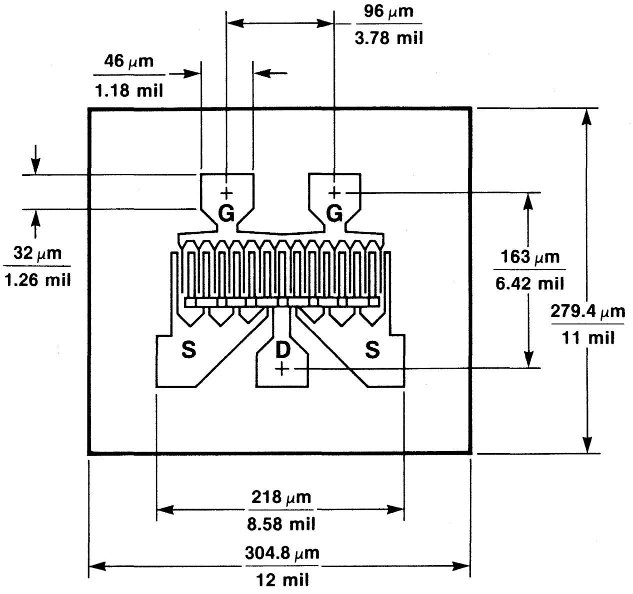
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.98	– 17	14.3	5.17	163	– 37.1	.014	79	.57	– 12
1.0	.96	– 34	14.1	5.07	148	– 31.4	.027	69	.55	– 22
2.0	.98	– 69	13.7	4.82	118	– 25.8	.051	47	.52	– 45
3.0	.84	– 104	12.8	4.34	89	– 23.5	.067	26	.47	– 63
4.0	.75	– 133	11.5	3.77	63	– 22.4	.076	7	.43	– 87
5.0	.71	– 161	10.4	3.30	38	– 21.8	.081	– 6	.40	– 107
6.0	.69	173	9.3	2.91	17	– 21.7	.082	– 19	.39	– 125
7.0	.70	151	8.2	2.58	– 4	– 21.5	.084	– 30	.39	– 145
8.0	.67	135	7.2	2.28	– 24	– 21.4	.085	– 40	.41	– 160
10.0	.66	104	5.8	1.93	– 62	– 21.0	.089	– 60	.46	169
12.0	.75	73	5.0	1.77	– 106	– 20.3	.097	– 86	.56	134

AT-8251
2-12 GHz Low Noise Medium Power Gallium Arsenide FET

FEATURES

- **0.9 dB NF, 13 dB G_A @ 4 GHz**
- **1.3 dB NF, 11 dB G_A @ 6 GHz**
- **+21 dBm Linear $P_{1\,dB}$ @ 4 GHz**
- **All Gold Metallization**
- **Very Wide Dynamic Range**
- **Chip Form**

AVANTEK M125 CHIP



DESCRIPTION

The AT-8251 is a gallium arsenide Schottky-gate field effect transistor, particularly designed for simplified input matching, low noise figure, medium power, and wide dynamic range in the 2-12 GHz frequency range.

The AT-8251 is an unpackaged 11 x 12 mil chip usable in thin film and thick film hybrid circuits. Its gold and refractory metal system provides excellent bond strength and assures compatibility with the wire bonding techniques used in hybrid fabrication.

This unique GaAs FET combines a half-micron gate length with a 14 gate geometry utilizing air bridge crossovers that minimize both gate resistance and chip size.

The addition of high power capability to a low noise figure transistor permits an extremely wide dynamic range amplifier design.

The AT-8251, like all Avantek transistors, features a metal system that combines gold and refractory metals throughout. Even the gate is gold metalized. This minimizes the corrosion, intermetallic growth and burn out problems associated with some other metal systems used in GaAs FET fabrication—thus helping to assure excellent long term reliability.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 3V$, $I_{DS} = 20$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Spot Noise Figure	4 GHz	dB		0.9	
		6			1.3	
G_A	Gain at Optimum Noise Figure	4 GHz	dB		13	
		6			11	
NF_∞	N.F. of Infinite Cascade of AT-8251s	4 GHz	dB		1.0	
		6			1.4	
$P_{1\,dB}$	Output Power at 1 dB Gain Compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		+21	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$ ($I_{DS} = I_{DSS}$)		mmho	25	45	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	50	110	150
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2	−4
BV_{GD}	Breakdown Voltage — Gate-to-Drain: $I_{GD} = 100$ μA		V	−4.0		

RECOMMENDED MAXIMUM RATINGS

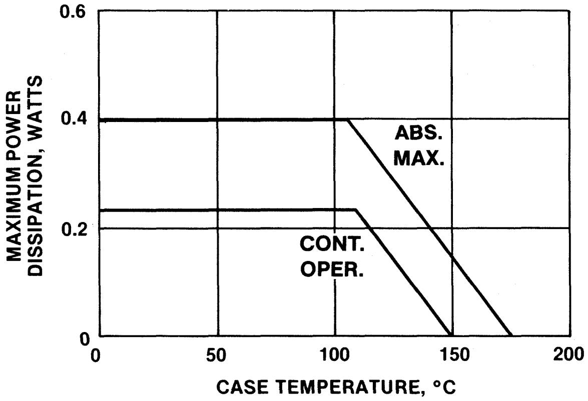
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 160°C/W (T_{CH} = 60°C)

Notes:

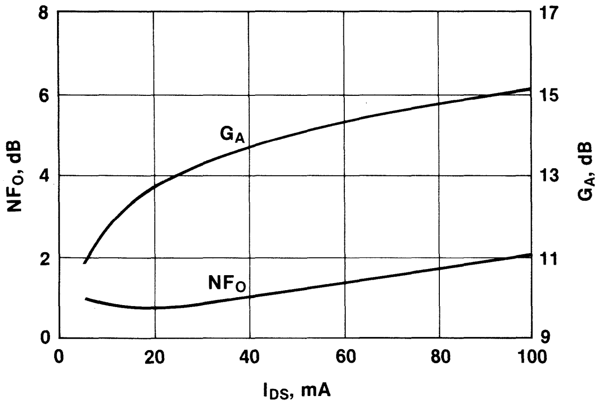
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

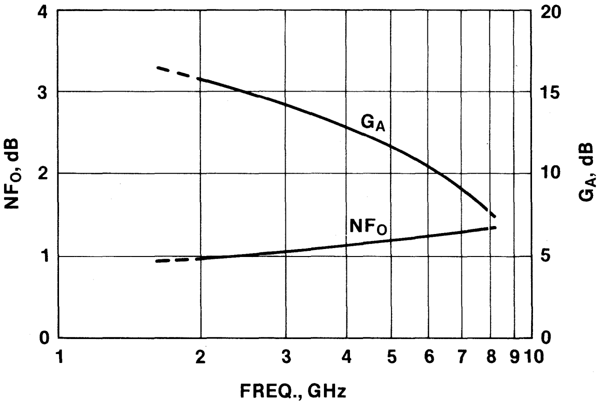


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. I_{DS} AT $V_{DS} = 3V$, FREQUENCY = 4 GHz

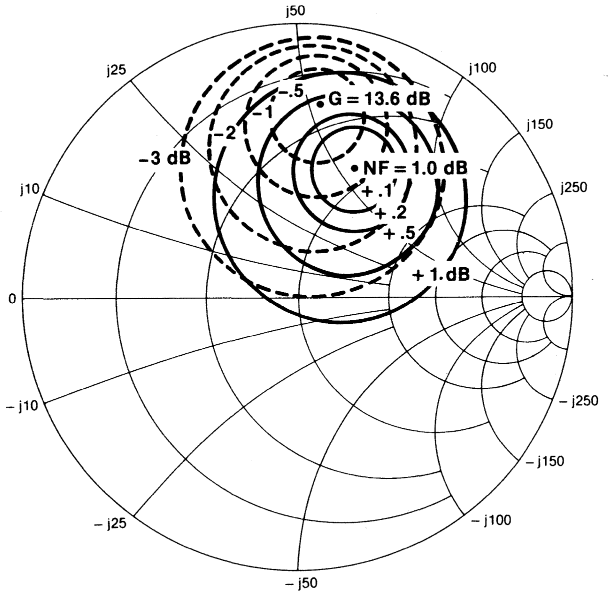


SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_{NF}) vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$ mA



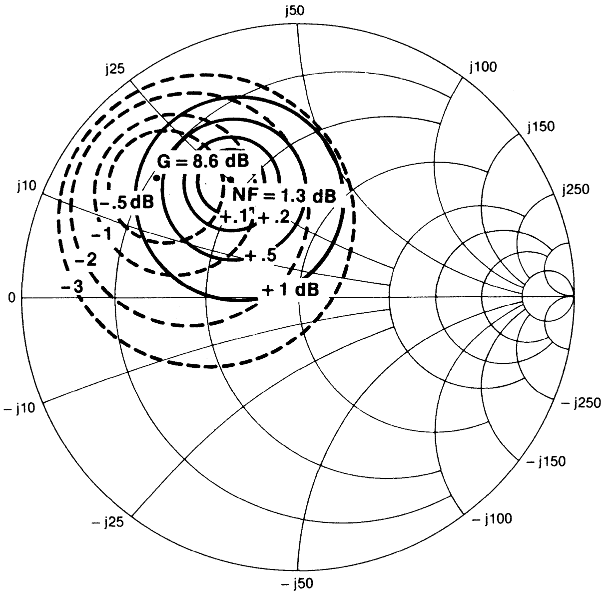
CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE

FREQUENCY = 4 GHz, $V_{DS} = 3V$, $I_{DS} = 20$ mA
G = 13.6 dB, NF = 1.0 dB



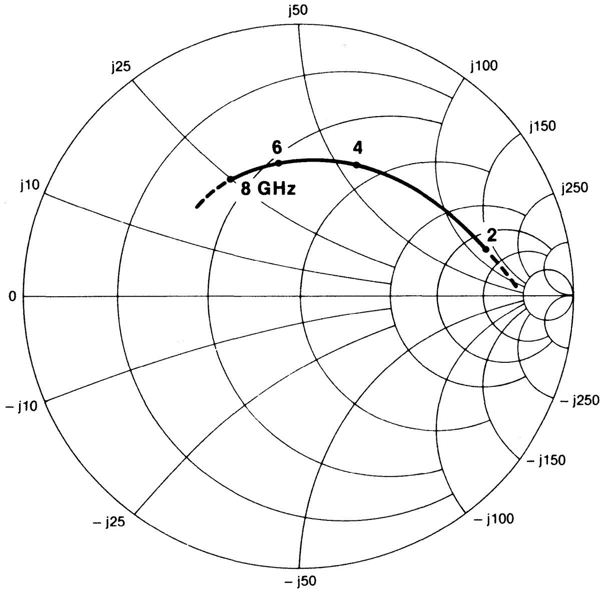
CONSTANT NOISE FIGURE AND GAIN vs. SOURCE IMPEDANCE

FREQUENCY = 8 GHz, $V_{DS} = 3V$, $I_{DS} = 20$ mA
G = 8.6 dB, NF = 1.3 dB



OPTIMUM SOURCE IMPEDANCE vs FREQUENCY

$V_{DS} = 3V$, $I_{DS} = 20$ mA

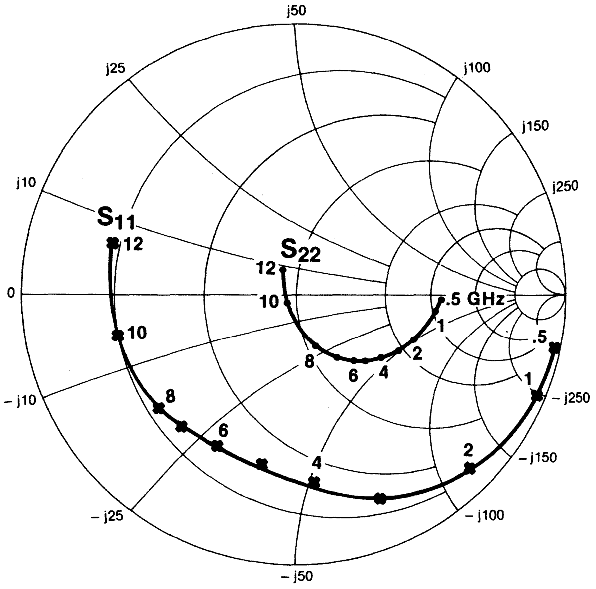


NOISE PARAMETERS vs. FREQUENCY

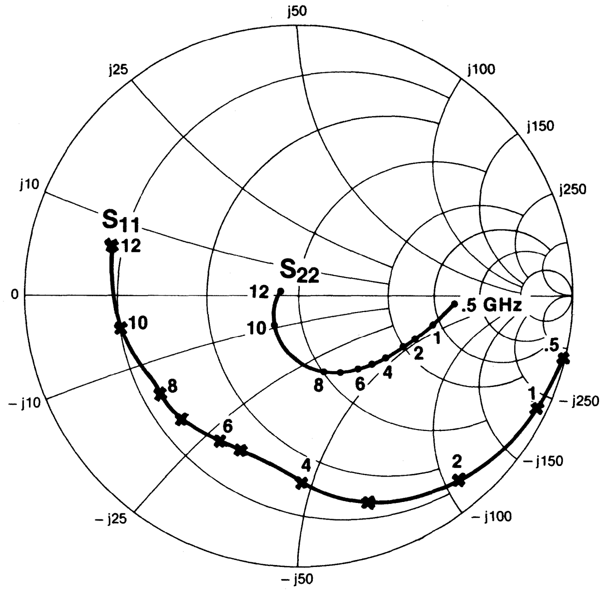
$V_{DS} = 3V$, $I_{DS} = 20$ mA

Freq. GHz	F_{min} dB	& GNF dB	$F_{50\ \Omega}$ dB	Γ_o Mag	Ang	R_N Ω
2	.97	15.8	2.29	.71	14	31.7
4	.99	13.5	2.09	.53	65	27.9
6	1.15	11.7	1.88	.49	97	13.9
8	1.29	9.8	2.27	.48	118	14.4

INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 3V$, $I_{DS} = 20$ mA



INPUT AND OUTPUT REFLECTION COEFFICIENT vs. FREQUENCY
$V_{DS} = 5V$, $I_{DS} = 50$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 3.0V$, $I_{DS} = 20$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.99	–11	12.4	4.36	170	–33.2	.022	85	.55	–3
1.0	.97	–22	12.6	4.28	161	–27.5	.042	81	.52	–6
2.0	.91	–45	12.3	4.13	144	–21.9	.080	70	.43	–20
3.0	.83	–66	11.6	3.79	127	–19.3	.108	60	.37	–25
4.0	.70	–82	10.4	3.30	113	–18.3	.122	52	.36	–34
5.0	.64	–99	9.3	2.92	101	–17.6	.132	49	.36	–42
6.0	.62	–115	8.3	2.60	93	–17.2	.138	46	.35	–50
7.0	.63	–128	7.4	2.35	84	–16.8	.144	44	.30	–60
8.0	.64	–138	6.8	2.19	76	–16.5	.149	42	.23	–72
10.0	.67	–165	5.9	1.96	57	–15.8	.162	34	.04	–123
12.0	.67	163	4.6	1.69	35	–15.3	.171	20	.13	160

$V_{DS} = 5.0V$, $I_{DS} = 50$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.98	–12	14.7	2.43	169	–34.9	.018	85	.58	–3
1.0	.95	–25	14.5	5.28	159	–29.4	.034	80	.55	–5
2.0	.89	–48	13.7	4.83	140	–23.9	.064	72	.44	–20
3.0	.81	–70	12.9	4.40	126	–21.2	.087	62	.40	–25
4.0	.68	–87	11.7	3.86	110	–20.3	.097	54	.37	–34
5.0	.58	–109	10.4	3.29	95	–20.2	.098	44	.33	–42
6.0	.58	–116	9.2	2.88	91	–19.5	.106	59	.35	–50
7.0	.60	–132	8.2	2.56	84	–18.0	.126	55	.32	–60
8.0	.60	–143	7.8	2.45	76	–18.1	.125	52	.30	–72
10.0	.64	–169	6.8	2.18	57	–17.3	.137	48	.14	–123
12.0	.69	163	5.4	1.86	35	–16.7	.147	37	.04	160

AT-10600
6-18 GHz, Small Signal Gallium Arsenide FET Chip

FEATURES

- **1.5 dB NF, 12.0 dB Gain @ 6 GHz**
- **1.8 dB NF, 9.0 dB Gain @ 12 GHz**
- **2.8 dB NF, 6.0 dB Gain @ 18 GHz**
- **+17 dBm $P_{1\,dB}$ @ 12 GHz**
- **Excellent Gain and Noise Flatness vs. I_{DS}**
- **Wide Dynamic Range**
- **All Gold-Based Metallization**

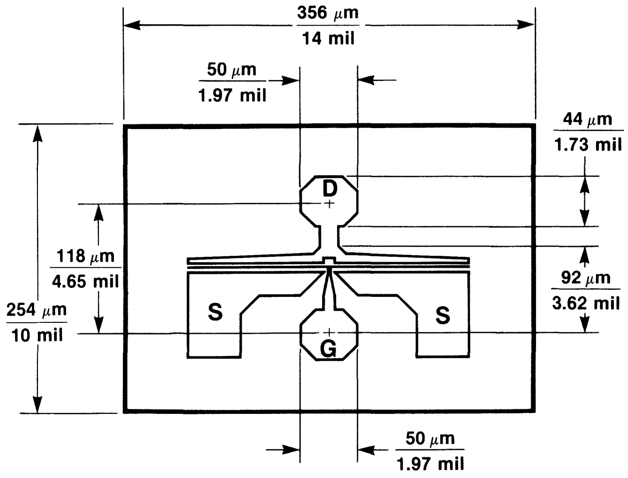
DESCRIPTION

The AT-10600 is a gallium arsenide, n-channel metal semiconductor field effect transistor (GaAs FET) with a 0.5 µm-length recessed Schottky barrier gate. It is designed for high gain, low noise amplification in both narrowband communications and radar amplifiers and in wideband electronic defense applications in the 6 to 18 GHz frequency range.

Among the performance features of this GaAs FET are the low noise operation and the particularly flat curves for insertion power gain ($|S_{21}|^2$), maximum available gain (MAG) and noise figure vs. drain current, from relatively low bias levels through I_{DSS}. This simplifies the bias requirements of amplifier stages using the AT-10600.

In the AT-10600, all metallization, including the gate, uses a system of gold and refractory metals to provide excellent bond strength and assure compatibility with the wirebonding techniques used in thin or thick film hybrid circuit construction. This eliminates the corrosion, intermetallic growth and burn-out problems associated with non-gold GaAs FET metal systems, thus helping to assure long term reliability under severe operating conditions.

AVANTEK M106 CHIP



ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: $V_{DS} = 3V$, $I_{DS} = 10$ mA	6 GHz	dB		1.5	
		12			1.8	
		18			2.8	
G_A	Gain @ NF_O: $V_{DS} = 3V$, $I_{DS} = 10$ mA	6 GHz	dB		12	
		12			9	
		18			6	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression $V_{DS} = 4.5V$, $I_{DS} = 30$ mA	12 GHz	dBm		+17	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0V$ ($I_{DS} = I_{DSS}$)		mmho	20	35	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	25	50	90
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2.0	−4
BV_{GD}	Breakdown voltage, Gate-to-Drain: $I_{GD} = 100$ µA		V	-4.0	−7	

RECOMMENDED MAXIMUM RATINGS

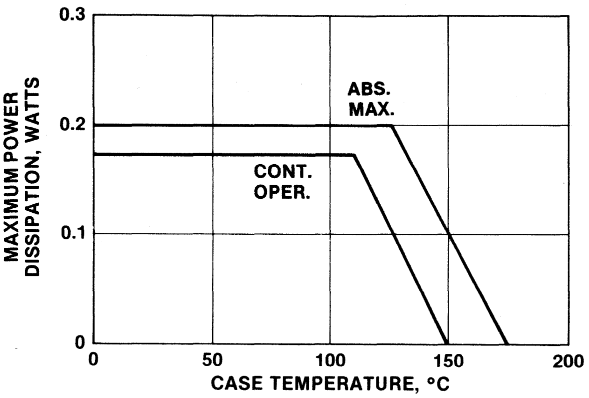
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation	P_T	180 mW	200 mW
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 160° C/W (T_{CH} = 60° C)

Notes:

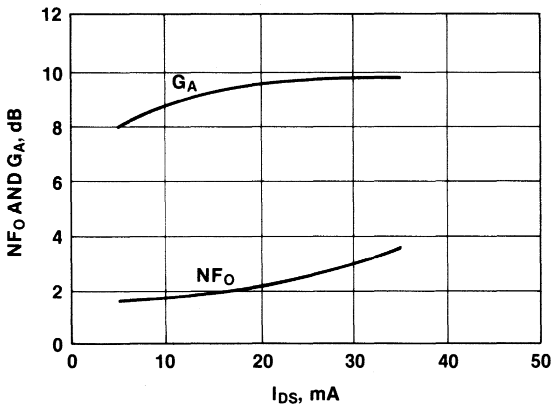
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

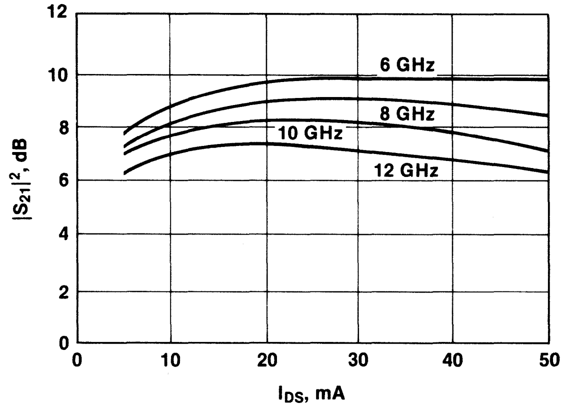


TYPICAL PERFORMANCE CURVES, T_A = 25°C

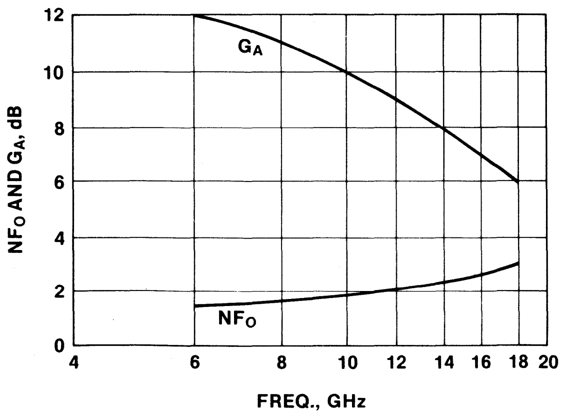
OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. I_{DS} V_{DS} = 3V, FREQUENCY = 12.0 GHz



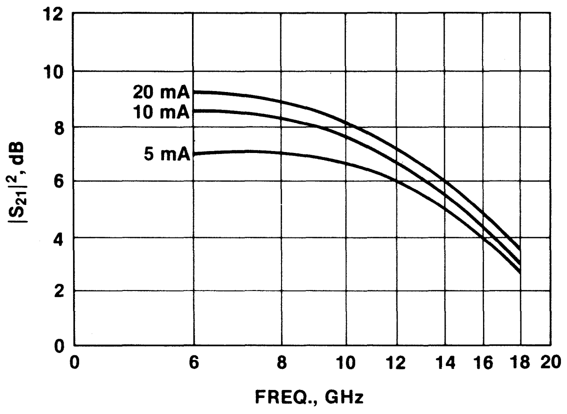
INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} AND FREQUENCY AT V_{DS} = 3V



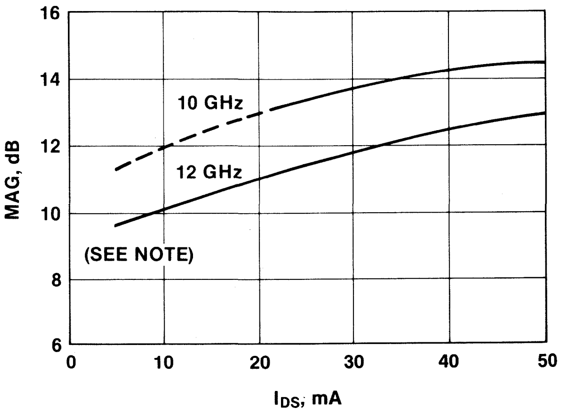
OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. FREQUENCY V_{DS} = 3V, I_{DS} = 10 mA



INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} AND FREQUENCY AT V_{DS} = 3V



MAXIMUM AVAILABLE GAIN (MAG)
vs. I_{DS} AT $V_{DS} = 3V$



Note: Dashed line indicates area of potential instability.

TYPICAL NOISE PARAMETERS vs. FREQUENCY
$V_{DS} = 3V$, $I_{DS} = 10$ mA

Freq. GHz	NF_O dB	G_A dB	Γ_o MAG	ANG	R_N Ω
8	1.6	11.5	.51	130	6.1
12	1.8	9	.59	157	2.8
14	2.2	7.5	.47	– 154	2.5

TYPICAL SCATTERING PARAMETERS, COMMON SOURCE *

Bias = 3.0 Volts, 10 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
6	.78	– 71	8.6	2.68	119	– 21.9	.08	64	.68	– 8
7	.71	– 85	8.3	2.59	110	– 21.0	.09	59	.63	– 10
8	.67	– 99	8.1	2.53	102	– 20.5	.09	57	.59	– 11
9	.63	– 114	7.9	2.49	90	– 19.8	.10	52	.55	– 13
10	.58	– 134	7.7	2.42	81	– 19.4	.11	48	.50	– 15
11	.57	– 153	7.5	2.36	70	– 19.2	.11	43	.43	– 18
12	.57	– 174	6.9	2.21	57	– 18.9	.11	36	.36	– 23
13	.59	169	6.1	2.01	47	– 18.8	.12	32	.29	– 28
14	.64	156	5.6	1.91	38	– 18.9	.11	25	.23	– 33
15	.66	144	4.9	1.74	28	– 18.9	.11	20	.16	– 50
16	.69	137	4.4	1.66	19	– 18.1	.12	16	.13	– 77
17	.70	125	3.7	1.52	8	– 17.9	.13	11	.12	– 103
18	.70	112	3.1	1.43	– 4	– 17.9	.13	5	.12	– 132

Bias = 4.5 Volts, 30.0 mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
6	.68	– 96	9.5	2.99	108	– 28.6	.04	80	.75	– 1
7	.61	– 112	8.8	2.76	100	– 28.0	.04	83	.72	– 2
8	.59	– 128	8.4	2.64	91	– 27.3	.04	88	.71	– 3
9	.56	– 145	8.0	2.50	81	– 26.2	.05	88	.70	– 3
10	.55	– 164	7.5	2.37	73	– 25.4	.05	90	.68	– 5
11	.56	178	7.1	2.27	63	– 24.4	.06	89	.64	– 8
12	.58	161	6.5	2.11	52	– 23.6	.07	84	.61	– 12
13	.62	150	5.7	1.92	44	– 22.6	.07	82	.57	– 18
14	.68	142	5.4	1.86	36	– 22.3	.08	78	.53	– 24
15	.70	133	4.7	1.71	25	– 21.4	.09	71	.47	– 37
16	.74	128	4.4	1.65	18	– 20.3	.10	65	.45	– 50
17	.76	117	3.7	1.52	6	– 19.3	.11	.58	.42	– 65
18	.75	105	3.1	1.43	– 5	– 19.0	.11	49	.40	– 80

AT-10650-1, -3
4-15 GHz, Small Signal Gallium Arsenide FET

FEATURES

- **1.5 dB NF, 12.0 dB Gain @ 6 GHz**
- **1.8 dB NF, 9.0 dB Gain @ 12 GHz**
- **+17 dBm $P_{1\,dB}$ @ 12 GHz**
- **Excellent Gain and Noise Flatness vs. I_{DS}**
- **Wide Dynamic Range**
- **All Gold-Based Metallization**
- **High Performance 50 mil package**

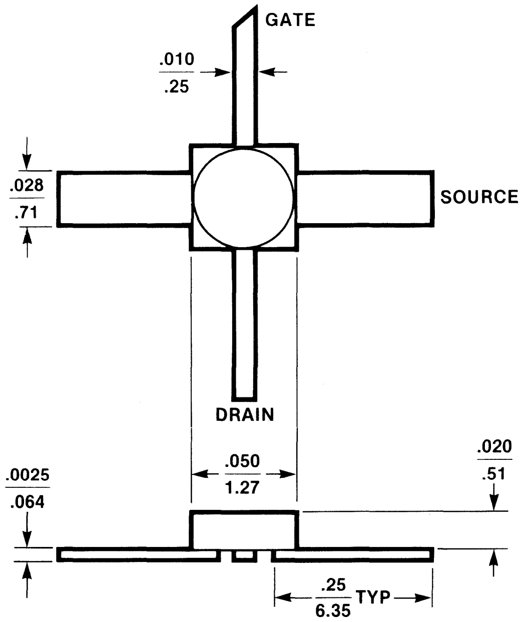
DESCRIPTION

The AT-10650 series is a gallium arsenide, n-channel metal semiconductor field effect transistor (GaAs FET) with a 0.5 μm-length recessed Schottky barrier gate. It is designed for high gain, low noise amplification in both narrowband communications and radar amplifiers and in wideband electronic defense applications in the 4 to 15 GHz frequency range.

Among the performance features of this GaAs FET are the low noise figure and flat curves for insertion power gain ($|S_{21}|^2$), maximum available gain (MAG) and noise figure vs. drain current, from relatively low bias levels through I_{DSS}. This simplifies the bias requirements of amplifier stages using the AT-10650.

In the AT-10650, all metallization, including the gate, uses a system of gold and refractory metals. This eliminates the corrosion, intermetallic growth and burn-out problems associated with non-gold GaAs FET metal systems, thus helping to assure long term reliability under severe operating conditions.

AVANTEK 50 mil FET PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Optn #	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: $V_{DS} = 3V$, $I_{DS} = 10$ mA	6 GHz	dB	−1		1.5	
				−3		1.9	
		12		−1		1.8	2.2
				−3		2.3	2.5
G_A	Gain @ Noise Figure: $V_{DS} = 3V$, $I_{DS} = 10$ mA	6 GHz	dB	−1		12.0	
				−3		11.0	
		12		−1	8.0	9	
				−3	6.5	8	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression $V_{DS} = 4.5V$, $I_{DS} = 30$ mA	12 GHz	dBm	All		17.5	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0V$ ($I_{DS} = I_{DSS}$)		mmho	All	20	35	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	All	25	50	90
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	All	−0.8	−2	−4
BV_{GD}	Breakdown Voltage, Gate-to-Drain: $I_{GD} = 100$ μA		V	All	−4	−7	

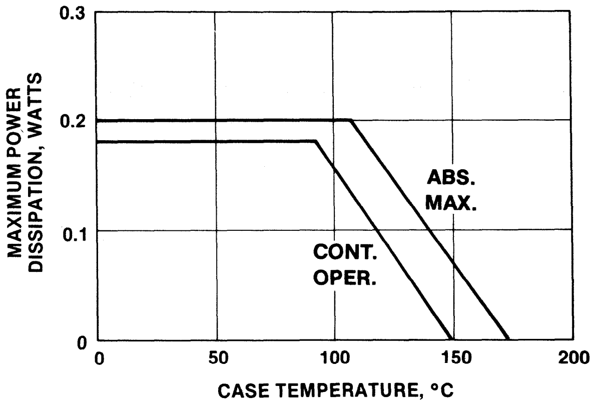
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	180 mW	200 mW
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 250°C/W (T_{CH} = 60°C)

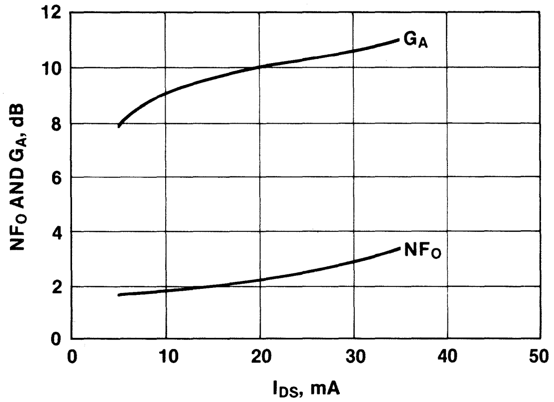
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

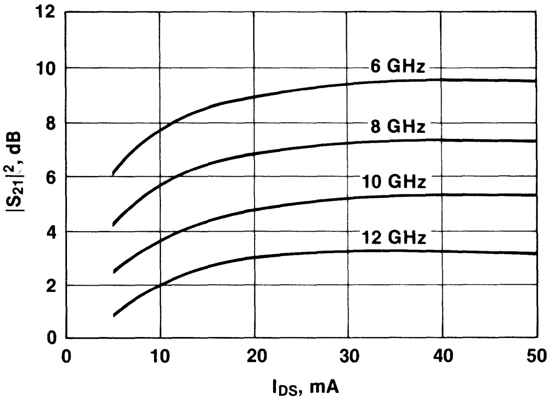


TYPICAL PERFORMANCE CURVES, T_A = 25°C

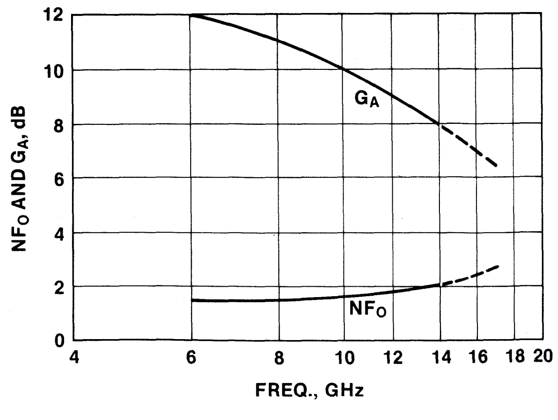
OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. I_{DS}
V_{DS} = 3V, FREQUENCY = 12.0 GHz



INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} AND FREQUENCY AT
V_{DS} = 3V



OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. FREQUENCY
V_{DS} = 3V, I_{DS} = 10 mA



TYPICAL NOISE PARAMETERS vs. FREQUENCY
V_{DS} = 3V, I_{DS} = 10 mA

Freq. GHz	NF_O dB	G_A dB	Γ_O Mag	Γ_O Ang	R_N Ω
8	1.6	11	.51	159	6.6
12	1.8	9	.61	180	3.5
14	2.0	7	.52	– 140	2.8

TYPICAL SCATTERING PARAMETERS, COMMON EMITTER*

AT-10650-1, -3 $V_{CE} = 8V$, $I_C = 10$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
6.0	.78	– 147	8.1	2.55	49	– 17.2	.138	– 17	.47	– 104
7.0	.74	– 174	7.3	2.31	26	– 16.8	.144	– 36	.42	– 127
8.0	.71	165	6.4	2.09	9	– 17.1	.140	– 52	.41	– 149
9.0	.69	147	5.7	1.92	– 11	– 17.3	.137	– 65	.41	– 172
10.0	.68	132	4.7	1.71	– 29	– 17.6	.132	– 76	.44	172
11.0	.68	117	4.0	1.58	– 47	– 17.8	.129	– 88	.47	157
12.0	.67	103	3.2	1.45	– 64	– 17.7	.130	– 100	.50	142
13.0	.67	92	2.2	1.29	– 78	– 18.5	.119	– 111	.53	130
14.0	.66	84	1.7	1.21	– 88	– 18.6	.118	– 119	.55	119
15.0	.65	74	1.4	1.18	– 104	– 18.7	.116	– 129	.59	109
16.0	.62	63	1.3	1.16	– 119	– 18.5	.119	– 136	.62	99
17.0	.59	51	.7	1.09	– 135	– 18.3	.122	– 147	.64	89
18.0	.51	31	.6	1.07	– 153	– 18.3	.121	– 162	.63	77

AT-10650-1, -3 $V_{CE} = 8V$, $I_C = 30$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
6.0	.73	– 159	10.0	3.18	45	– 20.7	.092	– 14	.48	– 95
7.0	.70	174	9.1	2.85	22	– 20.5	.094	– 31	.44	– 115
8.0	.68	153	8.1	2.55	5	– 20.8	.091	– 44	.43	– 137
9.0	.67	136	7.3	2.33	– 15	– 21.0	.089	– 54	.43	– 159
10.0	.66	121	6.3	2.07	– 32	– 21.2	.087	– 62	.46	– 176
11.0	.66	106	5.5	1.89	– 50	– 21.2	.087	– 72	.50	168
12.0	.66	93	4.7	1.71	– 67	– 21.0	.089	– 84	.52	152
13.0	.64	83	3.8	1.54	– 81	– 21.6	.083	– 91	.56	139
14.0	.63	74	3.2	1.44	– 91	– 21.3	.086	– 98	.57	128
15.0	.61	64	2.9	1.39	– 107	– 21.1	.088	– 107	.62	117
16.0	.57	52	2.7	1.36	– 122	– 20.6	.093	– 113	.65	106
17.0	.53	40	2.0	1.26	– 139	– 20.2	.098	– 122	.69	96
18.0	.45	18	1.8	1.23	– 157	– 19.9	.101	– 136	.68	84

AT-10650-5

4-15 GHz, Small Signal Gallium Arsenide FET

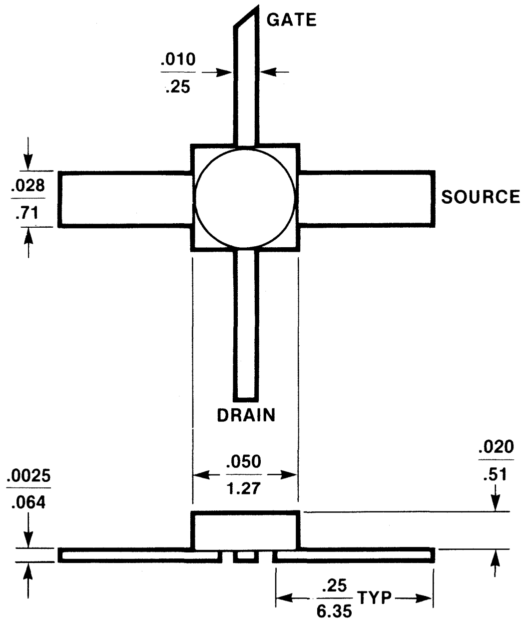
FEATURES

- **Low Cost**
- **Low Noise Figure**
  1.8 dB Typical @ 8 GHz
  2.5 dB Typical @ 12 GHz
- **High Associated Gain**
  10 dB Typical @ 8 GHz
  8 dB Typical @ 12 GHz
- **+18 dBm $P_{1\,dB}$ @ 12 GHz**
- **All Gold-Based Metallization**
- **High Performance .050" Package**

DESCRIPTION

The AT-10650-5 is a low cost, gallium arsenide field-effect transistor ideal for a wide variety of microwave applications and is offered in an hermetic, stripline package. This 0.5 μm gate length by 250 μm gate width device uses proven gold-based metal systems (Ti-W-Au for gate, Au-Ge-Ni-Au for drain and source) for enhanced performance and reliability. The device input S-parameters go through resonance (zero reactive impedance) at 8 GHz; the output S-parameters at 12 GHz. These factors make the device very easy to use in the 4 to 15 GHz frequency range.

AVANTEK 50 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: $V_{DS} = 3V$, $I_{DS} = 10$ mA	8 GHz 12	dB		1.9 2.5	 2.8
G_A	Gain @ NF_O: $V_{DS} = 3V$, $I_{DS} = 10$ mA	8 GHz 12	dB		10 8	
$P_{1\,dB}$	Power output @ 1 dB gain compression $V_{DS} = 4.5V$, $I_{DS} = 30$ mA	12 GHz	dBm		+18	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0V$		mmho	20	35	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	25	50	90
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2.0	−4.0
BV_{GD}	Breakdown voltage, gate-to-drain: $I_{GD} = 100$ μA		V	−4.0		

RECOMMENDED MAXIMUM RATINGS

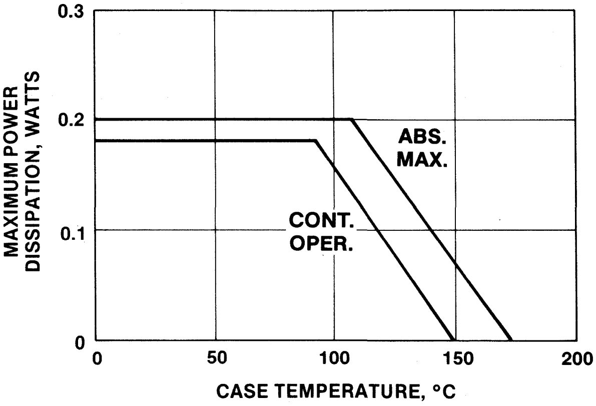
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	—4V	—5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	180 mW	200 mW
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 250° C/W (T_{CH} = 60° C)

Notes:

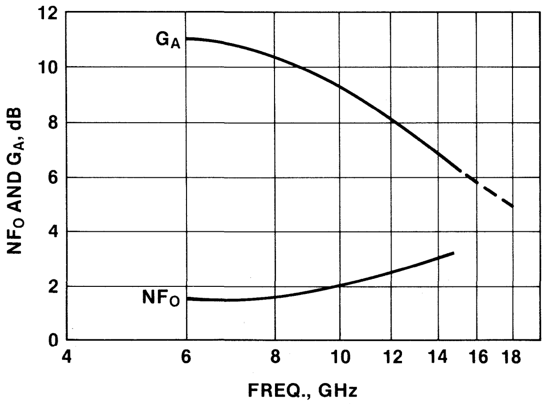
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

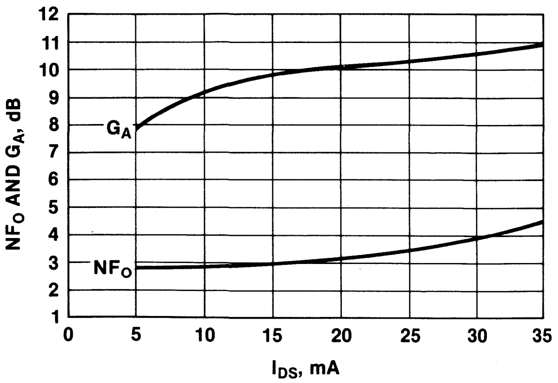
OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 10$ mA



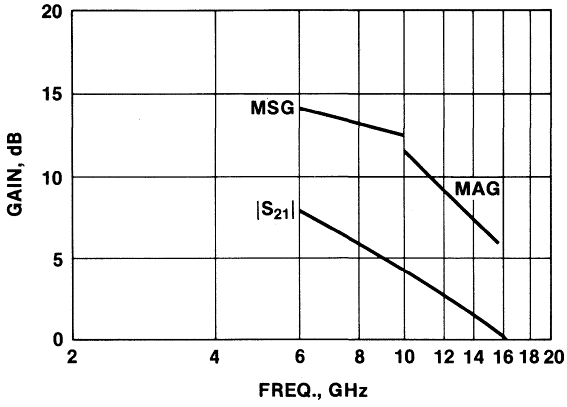
TYPICAL NOISE IMPEDANCES $V_{DS} = 3V$, $I_{DS} = 10$ mA

Freq. GHz	Reflection Coefficient, Γ_o	
	Mag	Ang
8.0	.51	159°
12.0	.61	179°
14.0	.52	140°

OPTIMUM NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. I_{DS} $V_{DS} = 3V$, FREQUENCY = 12 GHz



INSERTION POWER GAIN ($|S_{21}|^2$), MAXIMUM STABLE GAIN (MSB) AND MAXIMUM AVAILABLE GAIN (MAG) vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE *

$V_{DS} = 3V$, $I_{DS} = 10$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	**Mag**	**Ang**	**dB**	**Mag**	**Ang**	**dB**	**Mag**	**Ang**	**Mag**	**Ang**
6.0	.77	–146	7.8	2.46	51	–20.5	.094	–8	.63	–84
7.0	.75	–171	7.0	2.24	30	–20.0	.100	–25	.59	–102
8.0	.72	166	6.0	1.99	10	–20.3	.097	–40	.58	–121
9.0	.72	149	5.0	1.78	–8	–20.5	.094	–53	.59	–138
10.0	.70	134	4.1	1.61	–24	–21.1	.088	–63	.61	–153
11.0	.72	120	3.2	1.44	–40	–21.4	.085	–72	.64	–167
12.0	.70	108	2.3	1.31	–54	–21.4	.085	–78	.65	179
13.0	.69	98	1.6	1.20	–69	–21.4	.085	–88	.67	167
14.0	.69	89	1.2	1.15	–82	–21.6	.083	–95	.71	157
15.0	.64	79	0.7	1.08	–97	–21.7	.082	–102	.72	145

$V_{DS} = 6V$, $I_{DS} = 30$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	**Mag**	**Ang**	**dB**	**Mag**	**Ang**	**dB**	**Mag**	**Ang**	**Mag**	**Ang**
6.0	.72	–168	9.5	3.00	42	–26.2	.049	–0	.67	–78
7.0	.71	168	8.4	2.63	22	–26.0	.050	–12	.63	–94
8.0	.70	148	7.3	2.31	4	–26.0	.050	–22	.63	–112
9.0	.70	132	6.2	2.05	–15	–26.2	.049	–30	.64	–130
10.0	.69	117	5.3	1.85	–29	–26.6	.047	–33	.66	–145
11.0	.70	104	4.3	1.64	–46	–25.8	.051	–37	.69	–160
12.0	.68	93	3.5	1.49	–60	–24.9	.057	–43	.71	–174
13.0	.67	82	2.8	1.38	–74	–24.6	.059	–50	.72	173
14.0	.65	73	2.3	1.31	–88	–23.9	.064	–57	.76	162
15.0	.58	62	1.8	1.23	–104	–23.5	.067	–65	.78	150

AT-11571
0.5 Watt, 2–14 GHz
Gallium Arsenide FET

FEATURES

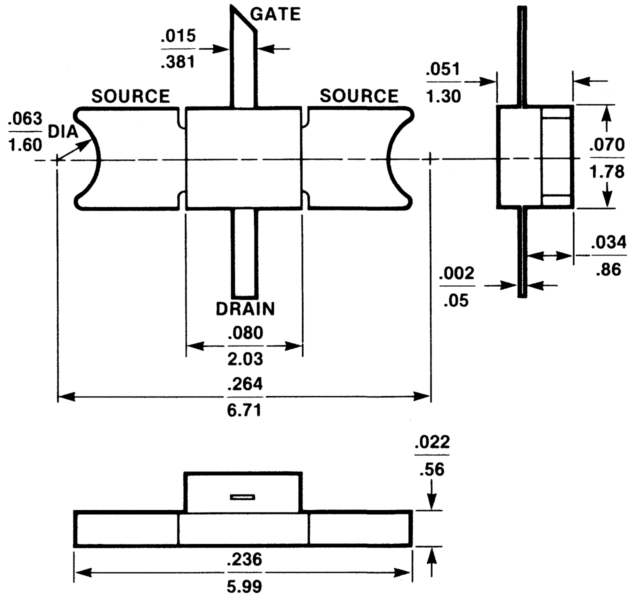
- **+28 dBm Min. Power Output $P_{1\,dB}$ @ 4 GHz**
- **10 dB Min. 1 dB Compressed Gain @ 4 GHz**
- **Up to 35% Power Added Efficiency**
- **Gold-Based Metallization for Reliability**
- **Optimized Power Epitaxy and Doping**
- **Hermetic Copper-Flange Stripline Package**

DESCRIPTION

The Avantek® AT-11571 is a gallium arsenide Schottky-gate field effect transistor designed for medium power, linear amplification in the 2 to 14 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET incorporates a chip (available in unpackaged form as the AT-8151) with a four-cell, 2.5-millimeter gate periphery structure with air-bridge interconnects between drain pads. It is supplied in the Avantek 70 mil FET flange package—a rugged, hermetic package with low parasitic reactance and minimum thermal resistance.

AVANTEK 70 MIL FLANGE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 250$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power at 1 dB Gain Compression,	4 GHz	dBm	28.0	29	
		8			28	
		12			27	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz	dB	10.0	12.0	
		8			7.0	
		12			5.5	
MAG	Maximum Available Gain	8 GHz	dB		9.0	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	150	225	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	400	600	800
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage, Gate to Drain: $I_{GD} = 1$ mA		V	-12	−16	

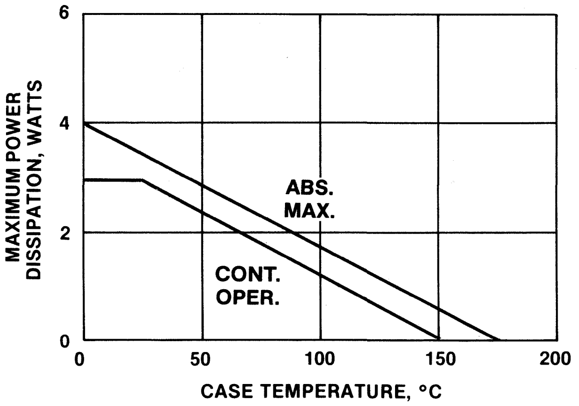
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	2.7 W	4.0 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	-65° C to 150° C	175° C

Thermal Resistance, θ_{jc}: 35° C/W (T_{CH} = 60° C)

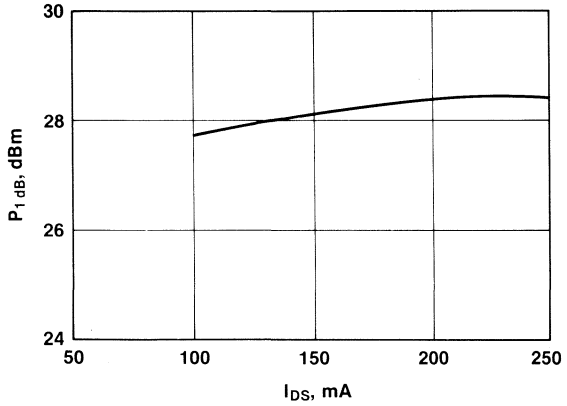
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25° C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

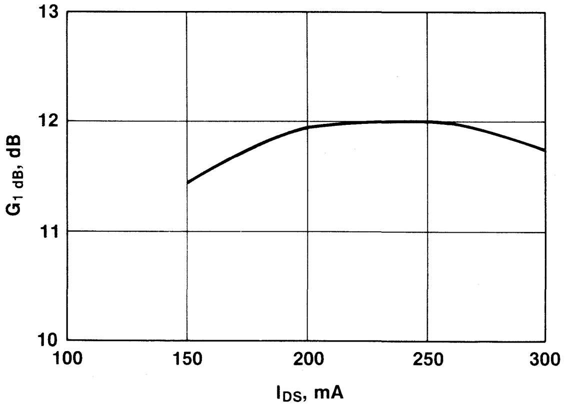


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

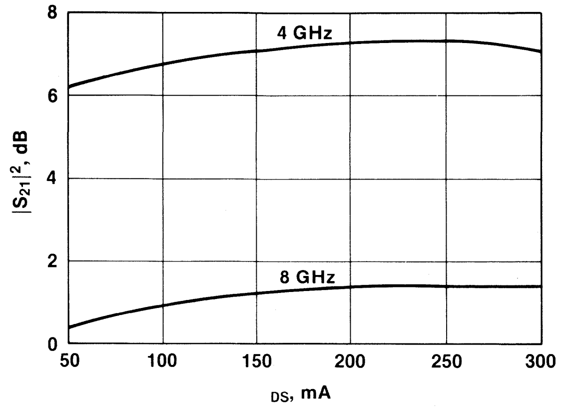
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz, V_{DS} = 9V



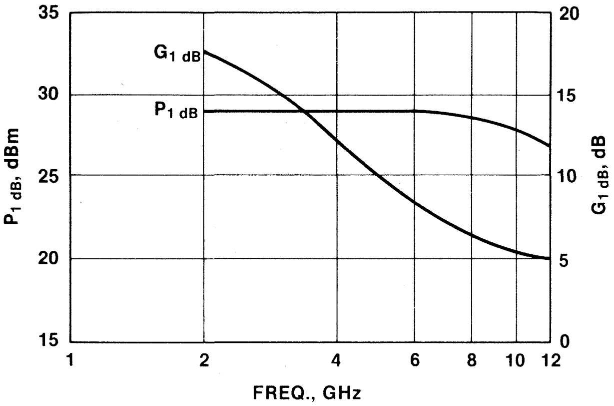
1 dB COMPRESSED GAIN ($G_{1\,dB}$) vs. I_{DS}
FREQUENCY = 4.0 GHz, V_{DS} = 9V



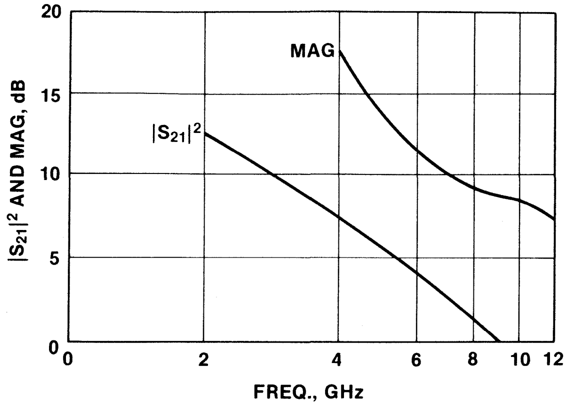
INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS}
FREQUENCY = 4.0, 8.0 GHz, V_{DS} = 9V



COMPRESSED POWER AND GAIN vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 250$ mA



SMALL SIGNAL GAIN ($|S_{21}|^2$) AND MAX AVAILABLE GAIN (MAG) vs. FREQUENCY
$V_{DS} = 9V$, $I_{DS} = 250$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 9V$, $I_{DS} = 250$ mA

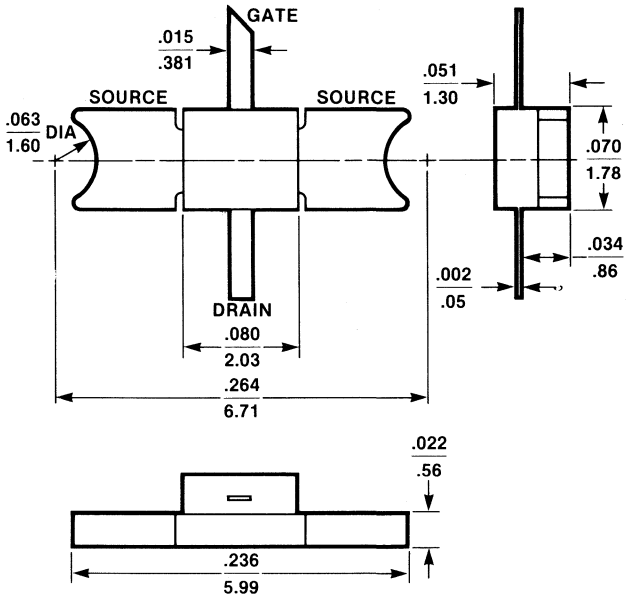
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.92	−68	19.9	9.93	137	−31.4	.027	53	.31	−48
1.0	.86	−103	17.1	7.19	113	−28.6	.037	37	.30	−71
2.0	.83	−135	12.5	4.20	93	−27.3	.043	24	.33	−89
4.0	.82	−165	7.2	2.30	61	−27.1	.044	26	.41	−104
6.0	.81	177	4.0	1.58	35	−26.7	.046	28	.46	−117
7.0	.82	164	2.2	1.29	20	−25.4	.054	35	.46	−132
8.0	.83	155	1.2	1.15	6	−24.4	.060	35	.52	−154
9.0	.81	152	−0.8	.91	−3	−22.6	.074	25	.59	−161
10.0	.79	145	−0.7	.92	−13	−22.2	.078	16	.65	−166
11.0	.75	129	−2.4	.76	−26	−21.3	.086	16	.67	−170
12.0	.78	113	−2.0	.79	−46	−21.4	.085	13	.68	176
14.0	.82	94	−5.8	.51	−74	−19.5	.106	−1	.73	140
16.0	.79	80	−7.3	.43	−90	−16.4	.152	−10	.78	127
18.0	.75	50	−8.6	.37	−111	−14.0	.199	−38	.78	106

AT-11671
0.25 Watt, 2-14 GHz
Gallium Arsenide FET

FEATURES

- +25 dBm Min. Power Output ($P_{1\,dB}$) @ 4 GHz
- 10 dB Min. 1 dB Compressed Gain @ 4 GHz
- Up to 35% Power Added Efficiency
- Gold-Based Metallization for Reliability
- Optimized Power Epitaxy and Doping
- Hermetic Copper-Flange Stripline Package

AVANTEK 70 MIL FET FLANGE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

DESCRIPTION

The Avantek® AT-11671 is a gallium arsenide Schottky-gate field effect transistor chip designed for medium power, linear amplification in the 2 to 14 GHz frequency range. This rugged, reliable device is suitable for a wide variety of applications such as communications and radar equipment operating in the space, airborne, military and commercial environments.

This GaAs FET incorporates a chip (available in unpackaged form as the AT-8161) with a two-cell, 1.25-millimeter gate periphery structure with air-bridge interconnects between drain pads. It is supplied in the Avantek 70 mil FET flange package—a rugged, hermetic package with low parasitic reactance and minimum thermal resistance.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, $I_{DS} = 125$ mA (unless otherwise specified)	Freq.	Units	Min.	Typ.	Max.
$P_{1\,dB}$	Output Power @ 1 dB Gain Compression	4 GHz 8 12	dBm	25.0	26.0 25.5 24.5	
$G_{1\,dB}$	1 dB Compressed Gain	4 GHz 8 12	dB	10.0	12.0 8.0 5.5	
MAG	Maximum Available Gain	8 GHz	dB		10.0	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0$		mmho	60	120	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0$		mA	200	300	450
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 5.0$ mA		V	-2.0	-3.5	-5.4
BV_{GD}	Breakdown Voltage, Gate-to-Drain: $I_{GD} = 1.0$ mA		V	-12	−16	

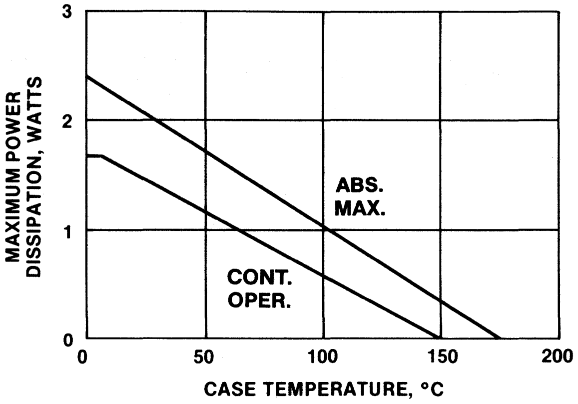
RECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+9V	+14V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	1.6 W	2.4 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 70°C/W (T_{CH} = 60°C)

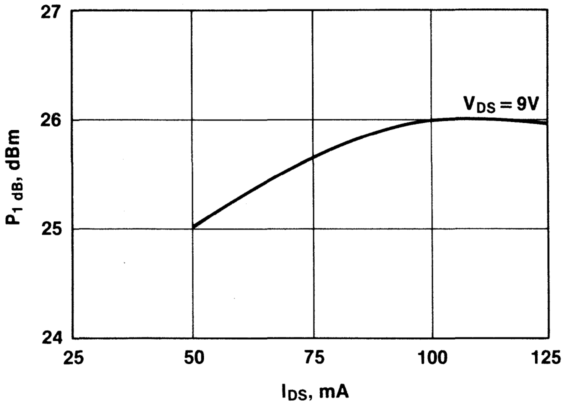
Notes:
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

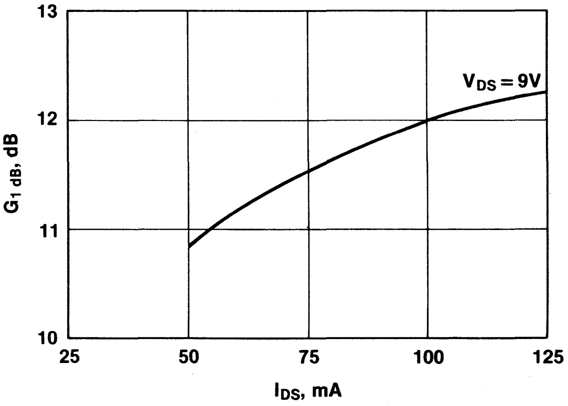


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

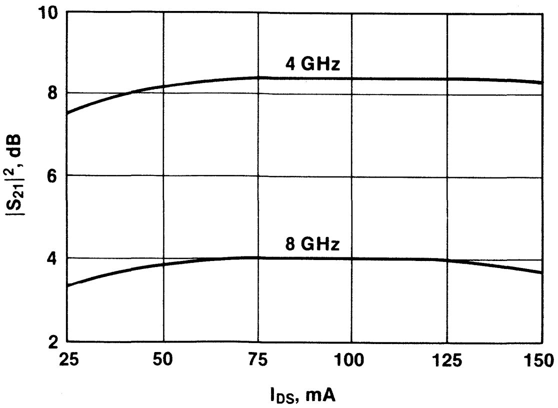
POWER OUTPUT @ 1 dB GAIN COMPRESSION ($P_{1\ dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



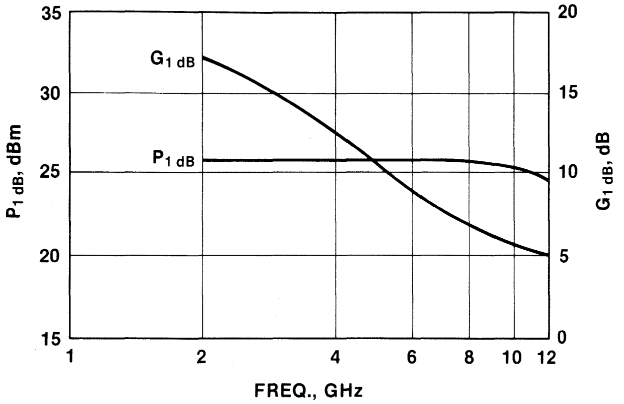
1 dB COMPRESSION GAIN ($G_{1\ dB}$) vs. I_{DS} FREQUENCY = 4.0 GHz



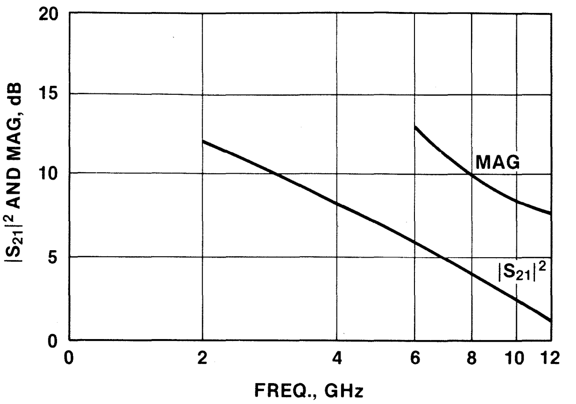
INSERTION POWER GAIN ($|S_{21}|^2$) vs. I_{DS} FREQUENCY = 4.0, 8.0 GHz, $V_{DS} = 9V$



POWER OUTPUT AND GAIN @ 1 dB GAIN COMPESSION vs. FREQUENCY
$V_{DS}=9V$, $I_{DS}=125$ mA



SMALL SIGNAL GAIN ($|S_{21}|^2$) AND MAX AVAILABLE GAIN (MAG) vs. FREQUENCY
$V_{DS}=9V$, $I_{DS}=125$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS}=9V$, $I_{DS}=125$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
0.5	.96	−34	16.1	6.41	152	−34.0	.020	71	.56	−17
1.0	.92	−60	15.4	5.88	134	−29.9	.032	57	.53	−29
2.0	.84	−94	12.0	3.96	114	−26.2	.049	39	.51	−47
4.0	.78	−136	8.3	2.59	79	−24.7	.058	26	.51	−63
6.0	.75	−162	5.8	1.94	52	−24.2	.062	24	.51	−74
7.0	.74	179	4.9	1.75	35	−23.6	.064	26	.47	−85
8.0	.75	166	4.0	1.58	21	−23.9	.066	20	.46	−111
9.0	.74	159	2.4	1.32	5	−22.9	.072	30	.53	−129
10.0	.71	147	1.9	1.24	−5	−20.1	.099	28	.60	−141
11.0	.64	128	1.1	1.13	−17	−19.8	.102	11	.60	−142
12.0	.67	108	0.4	1.05	−33	−19.2	.110	−1	.61	−145
14.0	.66	85	−1.3	.86	−64	−18.4	.120	−7	.61	−177
16.0	.66	62	−2.4	.76	−90	−15.4	.169	−20	.69	162
18.0	.60	25	−3.7	.65	−119	−13.2	.219	−51	.71	134

AT-12535
2–12 GHz Low Noise Gallium Arsenide FET

FEATURES

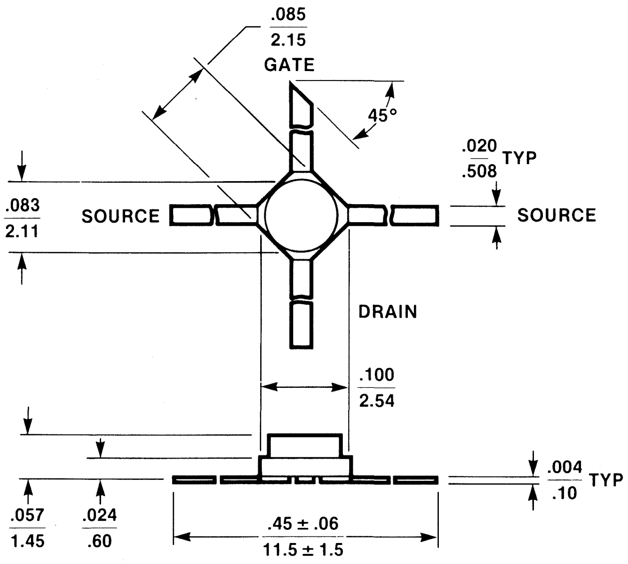
- **Low Cost**
- **Low Noise Figure**
  1.0 dB Typical @ 2 GHz
  1.2 dB Typical @ 4 GHz
- **High Associated Gain**
  15.5 dB Typical @ 2 GHz
  12.5 dB Typical @ 4 GHz
- **+20 dBm $P_{1\,dB}$ @ 4 GHz**
- **High Volume micro-X Package**

DESCRIPTION

The AT-12535 is a packaged gallium arsenide Schottky-gate field effect transistor. This part is designed for low noise and linear gain amplification in the 2 to 12 GHz frequency range. This rugged, reliable device is suitable for a wide variety of high volume applications such as consumer and communications equipment, operating in airborne and commercial environments.

This GaAs FET chip has a 0.5 μm gate length by 500 μm gate width structure with airbridge interconnects between drain pads. Further, this chip uses proven gold-based metal systems for enhanced performance and reliability.

AVANTEK micro-X FET PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: $V_{DS} = 3V$, $I_{DS} = 20$ mA	2 GHz	dB		1.0	
		4			1.2	1.5
G_A	Gain @ NF_O: $V_{DS} = 3V$, $I_{DS} = 20$ mA	2 GHz	dB		15.5	
		4			12.5	
$P_{1\,dB}$	Power Output @ 1 dB Gain Compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		20.0	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0V$		mmho	25	60	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	50	110	150
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	−0.8	−2.0	−4
BV_{GD}	Breakdown Voltage, Gate-to-Drain: $I_{GD} = 100$ μA		V	−4.0		

RECOMMENDED MAXIMUM RATINGS

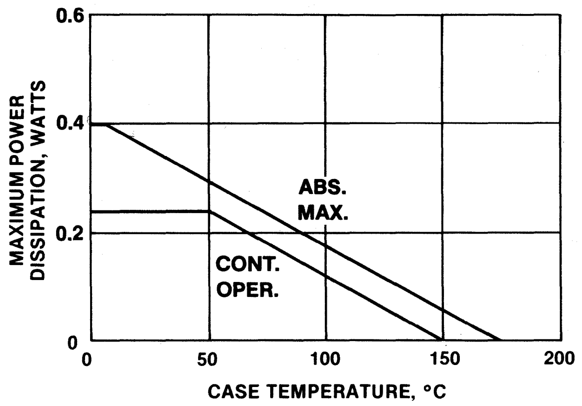
Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature[4]	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 300° C/W (T_{CH} = 60° C)

Notes:

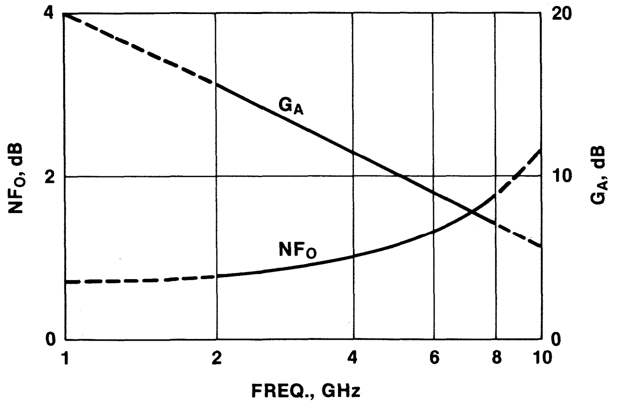
1. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
2. Operation of this device above any one of these parameters may cause permanent damage.
3. T_{CASE}=25°C.
4. Storage above +150°C may tarnish the leads of this package making it difficult to solder into a circuit. After a device has been soldered into a circuit, it may be safely stored up to 200°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE



TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

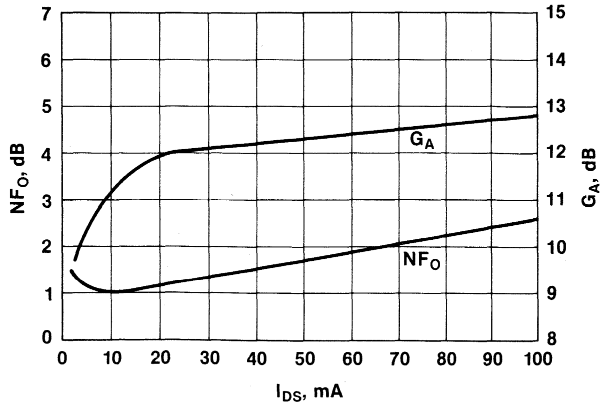
OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$ mA



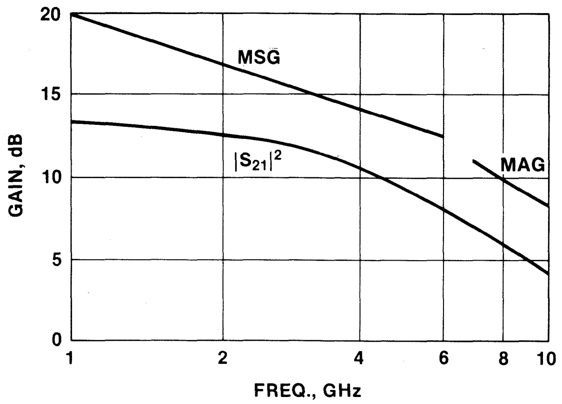
NOISE PARAMETERS vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$ mA

Freq. GHz	NF_O dB	G_A dB	F_{50} dB	Γ_O Mag	Ang	R_N Ω
2	0.91	16.0	1.90	.70	50	19.2
4	0.99	12.0	1.54	.45	93	12.0
6	1.43	9.8	1.63	.31	174	4.1
8	1.77	7.5	2.60	.50	– 150	6.1

OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. I_{DS} $V_{DS} = 3V$, FREQUENCY = 4 GHz



INSERTION POWER GAIN, MAXIMUM STABLE GAIN AND MAXIMUM AVAILABLE GAIN vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$ mA



TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

$V_{DS} = 3V$, $I_{DS} = 20$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.97	−34	12.8	4.37	148	−27.3	.043	67	.64	−21
2.0	.88	−69	12.3	4.11	117	−21.8	.081	47	.57	−41
3.0	.77	−106	11.7	3.86	87	−19.1	.110	26	.48	−63
4.0	.65	−145	10.5	3.34	58	−18.1	.125	7	.37	−84
5.0	.60	178	9.4	2.95	31	−17.5	.134	−9	.25	−110
6.0	.60	145	8.0	2.51	7	−17.4	.135	−22	.19	−142
7.0	.63	119	6.7	2.17	−15	−17.4	.136	−33	.17	−179
8.0	.63	97	5.9	1.97	−34	−17.2	.138	−41	.18	153
9.0	.66	77	4.9	1.76	−55	−17.0	.142	−52	.21	125
10.0	.69	56	4.1	1.61	−75	−16.5	.159	−62	.24	99
12.0	.75	24	2.4	1.32	−112	−16.0	.158	−82	.33	57

$V_{DS} = 5V$, $I_{DS} = 50$mA

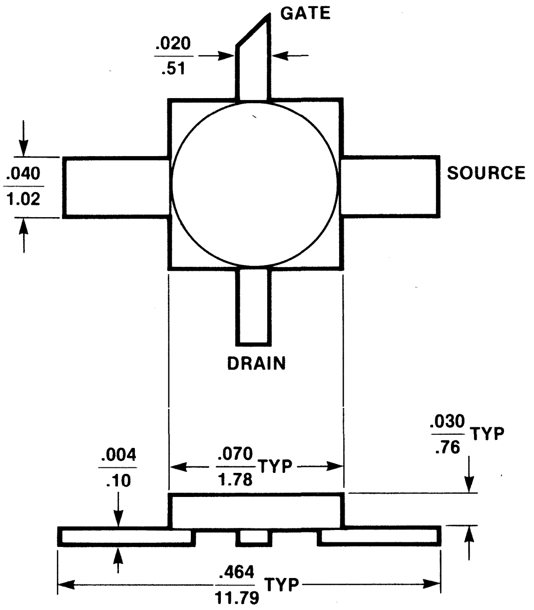
Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.95	−38	14.3	5.19	145	−29.5	.033	66	.71	−19
2.0	.84	−76	13.5	4.72	113	−24.4	.060	47	.64	−37
3.0	.72	−114	12.6	4.26	82	−22.2	.078	29	.56	−54
4.0	.61	−155	11.1	3.61	55	−21.3	.086	14	.48	−71
5.0	.58	169	10.0	3.18	29	−20.7	.093	4	.39	−88
6.0	.60	138	8.7	2.71	6	−20.2	.098	−3	.35	−109
7.0	.63	114	7.5	2.36	−17	−19.6	.105	−11	.32	−133
8.0	.64	93	6.7	2.16	−35	−18.6	.117	−15	.31	−158
9.0	.67	74	5.6	1.89	−56	−17.6	.132	−26	.32	179
10.0	.71	54	4.9	1.76	−76	−16.5	.150	−36	.33	153
12.0	.78	23	3.4	1.48	−113	−14.9	.181	−58	.39	103

AT-12570-5
2-12 GHz, Small Signal
Gallium Arsenide FET

FEATURES

- Low Cost
- Low Noise Figure
  0.9 dB Typical @ 2 GHz
  1.2 dB Typical @ 4 GHz
- High Associated Gain
  15 dB Typical @ 2 GHz
  12 dB Typical @ 4 GHz
- +20 dBm $P_{1\,dB}$ @ 4 GHz
- High Performance .070" Package

AVANTEK 70 MIL STRIPLINE PACKAGE



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

DESCRIPTION

The AT-12570-5 is a low cost, gallium arsenide field-effect transistor ideal for a wide variety of applications and is offered in a hermetic, stripline package. This 0.5 μm gate length by 500 μm gate width device uses proven gold-based metal systems (Ti-W-Au for gate, Au-Ge-Ni-Au for drain and source) for enhanced performance and reliability. The device input S-parameters go through resonance (zero reactive impedance) at 6 GHz; the output S-parameters at 8 GHz. These factors make the device very easy to use in the 2 to 12 GHz frequency range.

ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Freq.	Units	Min.	Typ.	Max.
NF_O	Optimum Noise Figure: $V_{DS} = 3V$, $I_{DS} = 20$ mA	2 GHz	dB		0.9	
		4	dB		1.2	1.5
G_A	Gain @ NF_O: $V_{DS} = 3V$, $I_{DS} = 20$ mA	2 GHz	dB		15	
		4	dB		12	
$P_{1\,dB}$	Power output @ 1 dB gain compression $V_{DS} = 5V$, $I_{DS} = 50$ mA	4 GHz	dBm		+20	
g_m	Transconductance: $V_{DS} = 3V$, $V_{GS} = 0V$ ($I_D = I_{DSS}$)		mmho	25	60	
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$		mA	50	110	150
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 1$ mA		V	− 0.8	− 2.0	− 4.0
BV_{GD}	Breakdown voltage, gate-to-drain: $I_{GD} = 100$ μA		V	− 4.0		

ECOMMENDED MAXIMUM RATINGS

Parameter	Symbol	Cont.[1] Oper.	Abs.[2] Max.
Drain-Source Voltage	V_{DS}	+5V	+7V
Gate-Source Voltage	V_{GS}	-4V	-5V
Drain Current	I_{DS}	I_{DSS}	I_{DSS}
Continuous Dissipation[3]	P_T	250 mW	400 mW
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	-65°C to 150°C	175°C

Thermal Resistance, θ_{jc}: 250°C/W (T_{CH} = 60°C)

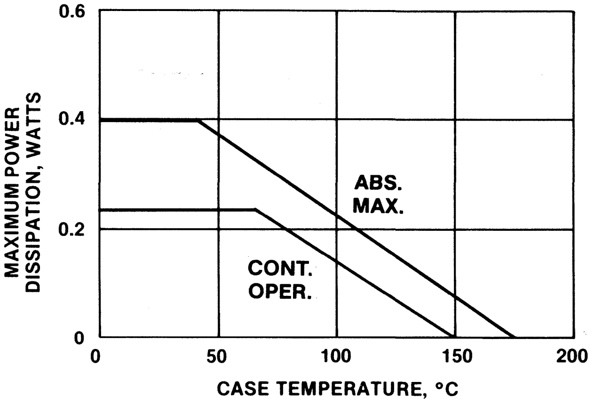
otes:

. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.

. Operation of this device above any one of these parameters may cause permanent damage.

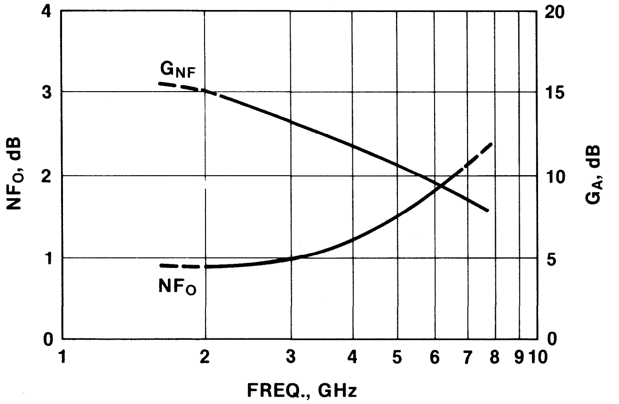
. T_{CASE} = 25°C.

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

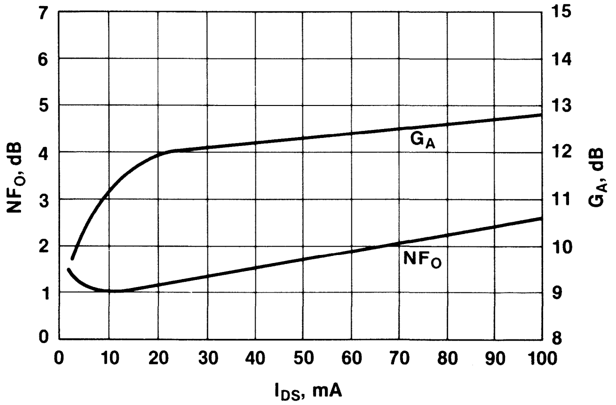


TYPICAL PERFORMANCE CURVES, $T_A = 25°C$

SPOT NOISE FIGURE (NF_O) AND ASSOCIATED GAIN (G_A) vs. FREQUENCY $V_{DS} = 3V$, $I_{DS} = 20$ mA



OPTIMUM NOISE FIGURE AND ASSOCIATED GAIN vs. I_{DS} $V_{DS} = 3V$, FREQUENCY = 4 GHz



TYPICAL NOISE IMPEDANCES, $V_{DS} = 3V$, $I_{DS} = 20$ mA

Freq. GHz	Reflection Coefficient, Γ_o		R_N Ω
	Mag	Ang	
2.0	.74	45°	30
4.0	.60	121°	10
6.0	.55	177°	4.4

TYPICAL SCATTERING PARAMETERS, COMMON SOURCE*

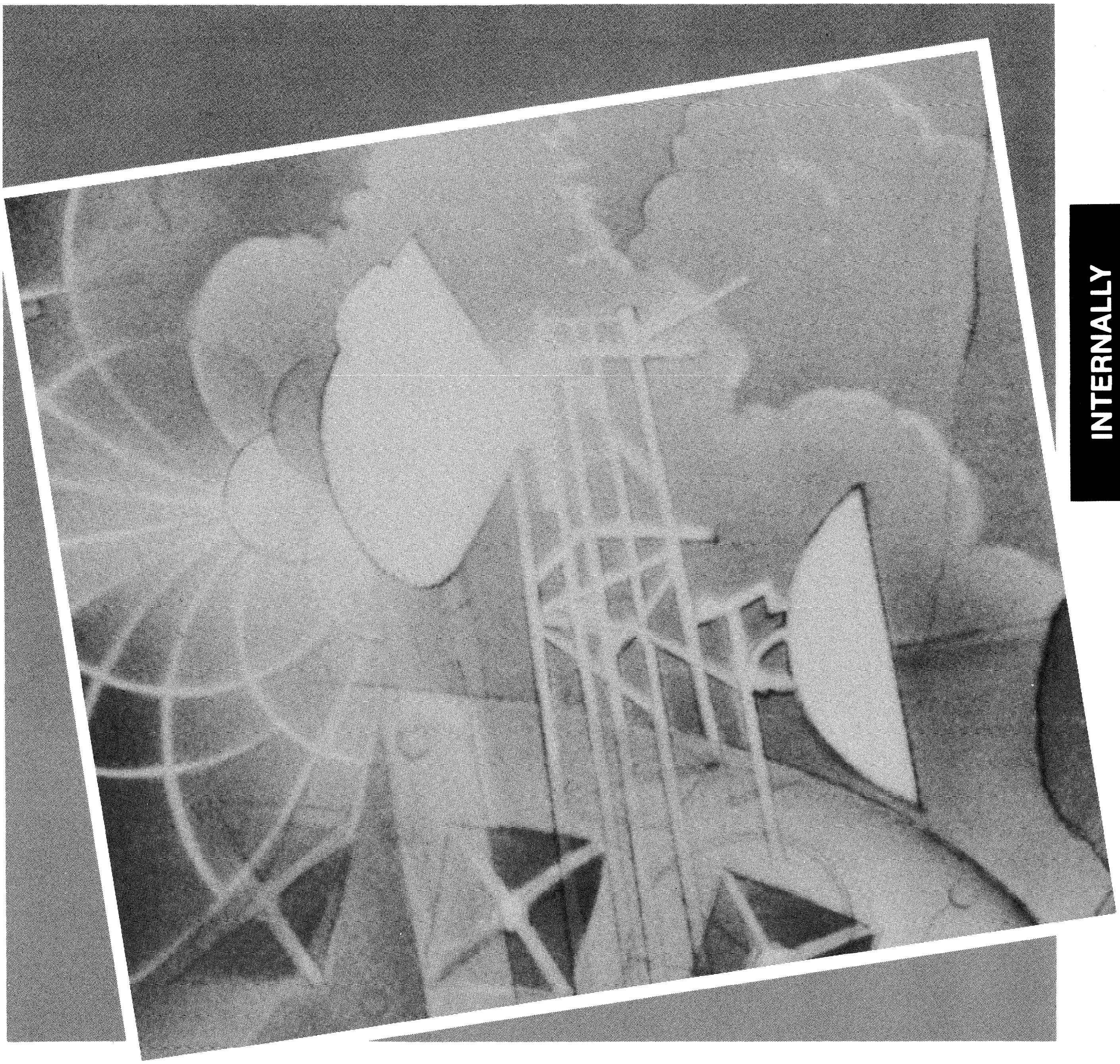
$V_{DS} = 3V$, $I_{DS} = 20$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.96	−32	12.1	4.02	150	−28.9	.036	68	.51	−23
2.0	.92	−64	11.8	3.91	121	−23.3	.068	45	.48	−49
3.0	.86	−98	11.2	3.61	93	−20.6	.093	23	.43	−75
4.0	.78	−126	10.1	3.19	66	−19.5	.106	3	.38	−97
5.0	.74	−155	9.1	2.84	41	−18.8	.115	−14	.35	−119
6.0	.71	179	8.1	2.54	20	−18.6	.117	−29	.33	−140
7.0	.72	156	7.1	2.27	−1	−18.6	.118	−43	.33	−159
8.0	.69	139	6.1	2.02	−21	−18.7	.116	−57	.34	−174
10.0	.68	107	4.7	1.72	−59	−18.9	.114	−81	.38	153

$V_{DS} = 5V$, $I_{DS} = 50$ mA

Freq.	S_{11}		S_{21}			S_{12}			S_{22}	
GHz	Mag	Ang	dB	Mag	Ang	dB	Mag	Ang	Mag	Ang
1.0	.96	−34	14.1	5.07	148	−31.4	.027	69	.55	−22
2.0	.90	−69	13.7	4.82	118	−25.8	.051	47	.52	−45
3.0	.84	−104	12.7	4.34	89	−23.5	.067	26	.47	−63
4.0	.75	−133	11.5	3.77	63	−22.4	.076	7	.43	−87
5.0	.71	−161	10.4	3.30	38	−21.8	.081	−6	.40	−107
6.0	.69	173	9.3	2.91	17	−21.7	.082	−19	.39	−125
7.0	.70	151	8.2	2.58	−4	−21.5	.084	−30	.39	−145
8.0	.67	135	7.2	2.28	−24	−21.4	.085	−40	.41	−160
10.0	.66	104	5.7	1.93	−62	−21.0	.089	−60	.46	169

IMFET™
Internally Matched High Power GaAs FETs



INTERNALLY MATCHED FETs

INTRODUCTION – INTERNALLY MATCHED POWER GaAs FETs

Avantek's IMFET™ family of internally matched field effect transistors offers the designer entirely matched power amplifier modules suitable for use in commercial, military and spaceborne applications. These devices are designed to operate over specific telecommunications and radar bands, but can be optimized for special applications requiring extended bandwidth or other specific product requirements.

Avantek IMFET devices offer high associated gain, power added efficiency and linearity. Power outputs are typically over 4 Watts for the "–3" devices and typically 7 Watts for the "–6" devices. As with the Avantek unmatched GaAs FET devices, every IMFET produc features the same level of quality and reliability as thos which are screened for spaceborne applications.

Every standard Avantek IMFET device is supplied wit complete characterization data over the specified ban of operation at no additional charge. This includes ou put power and associated gain at 1 dB gain compres sion and measured thermal resistance.

Avantek IMFET products are available in large quantitie at competitive prices. Contact your local Avantek repre sentative for price and delivery.

Guaranteed Performance: INTERNALLY MATCHED POWER GaAs FETs (IMFETs™)

Part Number	Minimum Frequency Range (GHz)	P_{1dB} Typical (dBm)	G_{1dB} Typical (dB)	add Typical (%)	P_T Maximum (W)	Package
IM-2935-3	2.9-3.5	36.0	11.5	35	17.5	IMFET
IM-3742-3	3.7-4.2	36.0	11.5	35	17.5	IMFET
IM-3742-6	3.7-4.2	38.5	9.5	30	44.0	IMFET
IM-4450-3	4.4-5.0	36.0	10.5	35	17.5	IMFET
IM-4450-6	4.4-5.0	38.5	8.5	30	44.0	IMFET
IM-5459-3	5.4-5.9	36.0	9.0	35	17.5	IMFET
IM-5964-3	5.9-6.4	36.0	9.0	35	17.5	IMFET
IM-5964-6	5.9-6.4	38.5	7.5	30	44.0	IMFET
IM-6471-3	6.4-7.1	36.0	8.0	35	17.5	IMFET
IM-7178-3	7.1-7.8	36.0	7.5	35	17.5	IMFET
IM-7984-3	7.9-8.4	36.0	7.0	35	17.5	IMFET

IM-2935-3
3 Watt, 2.9-3.5 GHz Internally Matched Power GaAs FET

FEATURES

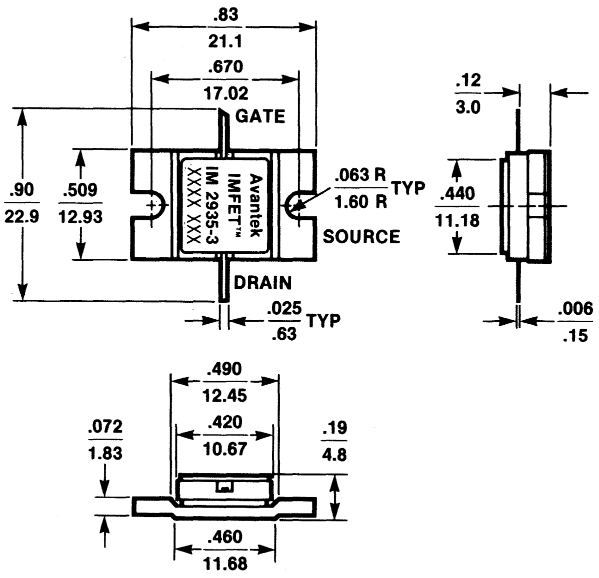
- 2.9-3.5 GHz Bandwidth
- Class A Operation
- Input and Output Internally Matched
- High Gain
- 3 Watt Output Power
- High Power Added Efficiency
- Hermetically Sealed Metal Ceramic Package

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-2935-3 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3). The internal input and output matching circuits have been designed to optimize performance in the 2.9-3.5 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES. (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, T_A = 25°C

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 2.9-3.5 GHz (unless otherwise specified)	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1 dB $I_D \leq 1.2$ A	dBm	34.8	36.0	
G_{1dB}	Gain at 1dB Compression Point $I_D \leq 1.2$ A	dB	10	11.5	
η_{add}	Power Added Efficiency[1] $I_D \leq 1.2$ A	%	30	35	
VSWR	Small Signal Input VSWR[2]			2.0	

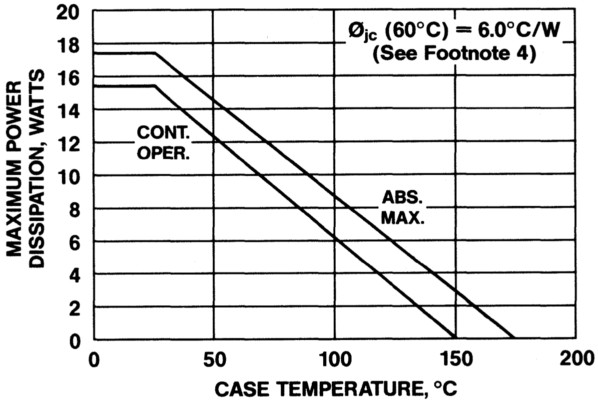
ELECTRICAL SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 10$ mA	volts	-1.7	-3.0	-6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: $V_{DS} = 0V$, $I_{GS} = 1$ mA	volts	-8	-14	
g_m	Transconductance: $V_{DS} = 3V$, $I_{DS} = I_{DSS}$	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] $T_{CH} = 60°C$	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

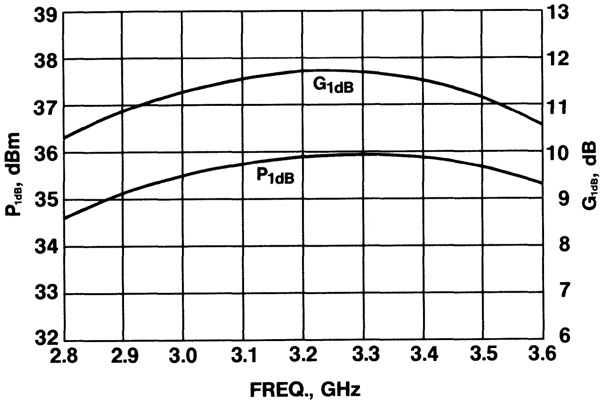
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

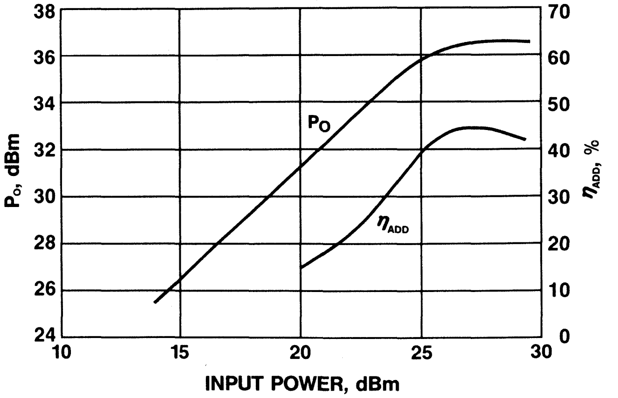


TYPICAL PERFORMANCE CURVES, $T_A=25°$ C

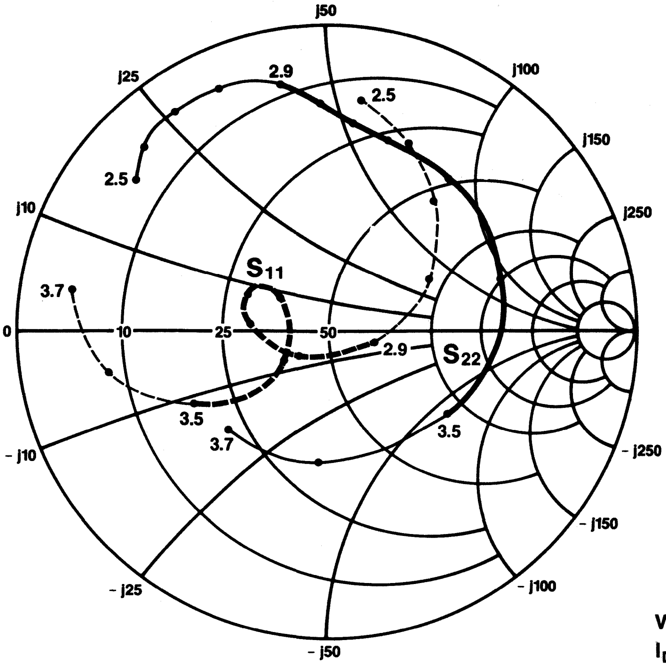
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



OUTPUT POWER (P_O) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 3.2 GHz, $V_{DS} = 9V$, $I_{DS} = 1.0A$

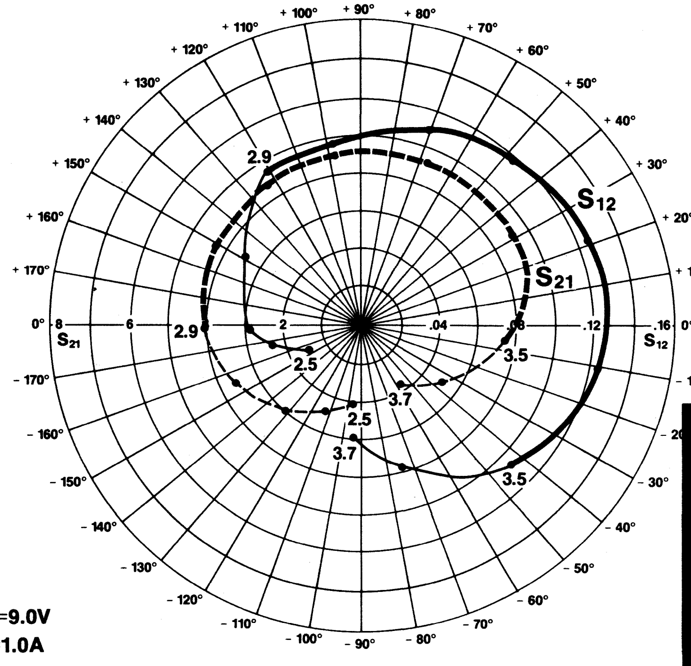


INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
2.5	.78	83.1	2.17	-96.2	.035	-151.0	.82	140.4
2.6	.69	68.5	2.55	-112.3	.046	-169.4	.87	133.9
2.7	.55	53.2	3.07	-132.4	.059	171.3	.90	124.1
2.8	.36	29.5	3.63	-155.2	.073	147.2	.90	114.9
2.9	.14	-13.9	4.07	178.5	.088	121.2	.85	101.5
3.0	.13	-144.0	4.31	151.2	.099	95.8	.77	92.5
3.1	.26	174.4	4.44	124.5	.109	71.5	.70	83.7
3.2	.30	155.3	4.60	98.3	.116	47.4	.68	73.6
3.3	.20	144.0	4.67	68.3	.125	21.3	.65	53.1
3.4	.18	-150.5	4.52	33.0	.126	-10.9	.58	17.4
3.5	.50	-152.5	3.66	-4.9	.109	-46.5	.47	-36.7
3.6	.74	-171.7	2.57	-37.6	.078	-74.0	.43	-96.7
3.7	.86	169.9	1.71	-60.3	.054	-94.5	.48	-137.1

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \dfrac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with V_{DS} = 1.5 volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}\,(60°C)\;[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. T_{CASE} = 25°C.

IM-3742-3/6
3 & 6 Watt, 3.7-4.2 GHz Internally Matched Power GaAs FET

FEATURES

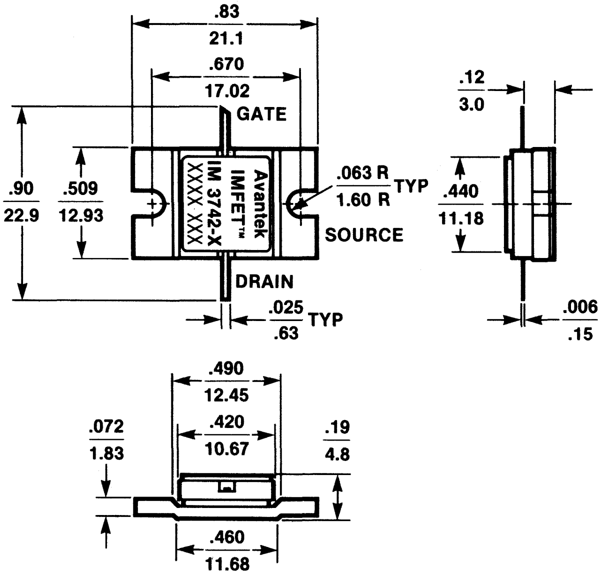
- **3.7-4.2 GHz Bandwidth**
- **Class A Operation**
- **Input and Output Internally Matched**
- **High Gain**
- **3 and 6 Watt Output Powers**
- **High Power Added Efficiency**
- **Hermetically Sealed Metal Ceramic Package**

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-3742 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3) and 20 mm for the 6 watt device (-6). The internal input and output matching circuits have been designed to optimize performance in the 3.7-4.2 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions $V_{DS} = 9V$, f = 3.7-4.2 GHz (unless otherwise specified)	Units	IM-3742-3 Min.	IM-3742-3 Typ.	IM-3742-3 Max.	IM-3742-6 Min.	IM-3742-6 Typ.	IM-3742-6 Max.
P_{1dB}	Output Power at 1 dB							
	$I_D \leq 1.2$ A	dBm	34.8	36.0				
	$I_D \leq 2.4$ A	dBm				37.8	38.5	
G_{1dB}	Gain at 1dB Compression Point							
	$I_D \leq 1.2$ A	dB	10	11.5				
	$I_D \leq 2.4$ A	dB				8.5	9.5	
η_{add}	Power Added Efficiency[1]							
	$I_D \leq 1.2$ A	%	30	35				
	$I_D \leq 2.4$ A	%				26	30	
VSWR	Small Signal Input VSWR[2]			2.0			2.0	

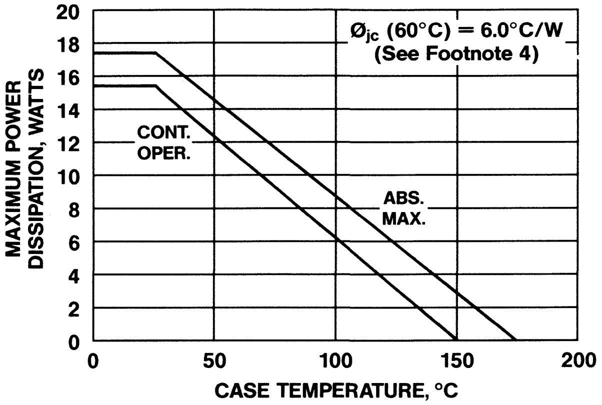
ELECTRICAL CHARACTERISTICS, $T_A = 25°C$

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: $V_{DS} = 3V$, $V_{GS} = 0V$	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: $V_{DS} = 3V$, $I_{DS} = 10$ mA	volts	–1.7	–3.0	–6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: $V_{DS} = 0V$, $I_{GS} = 1$ mA	volts	–8	–14	
g_m	Transconductance: $V_{DS} = 3V$, $I_{DS} = I_{DSS}$	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] $T_{CH} = 60°C$	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

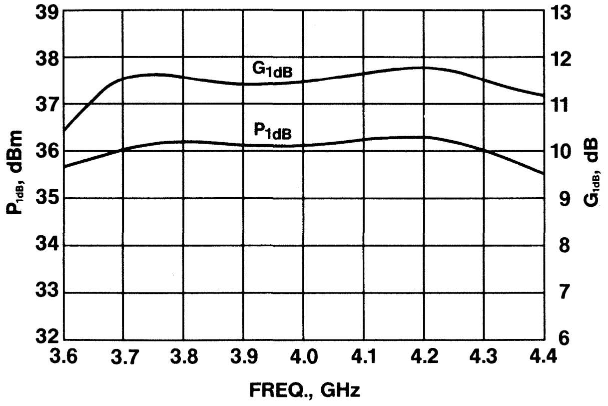
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

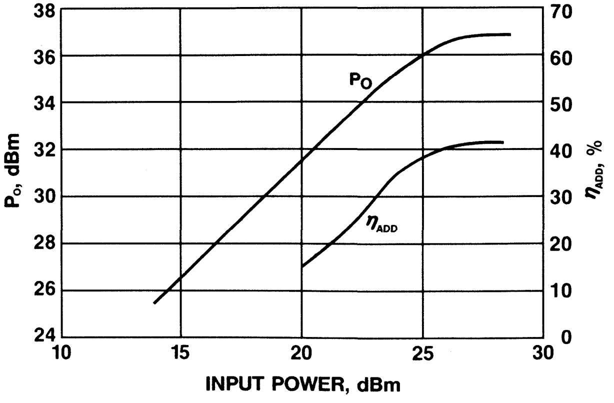


TYPICAL PERFORMANCE CURVES, T_A=25° C

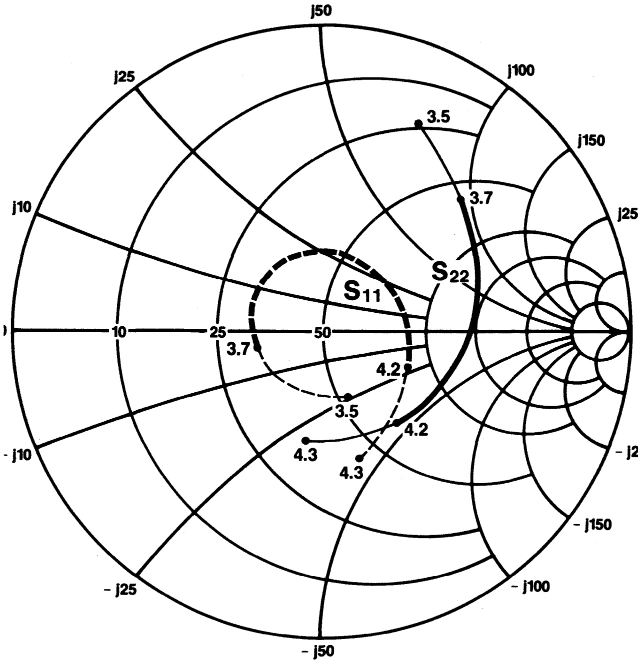
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



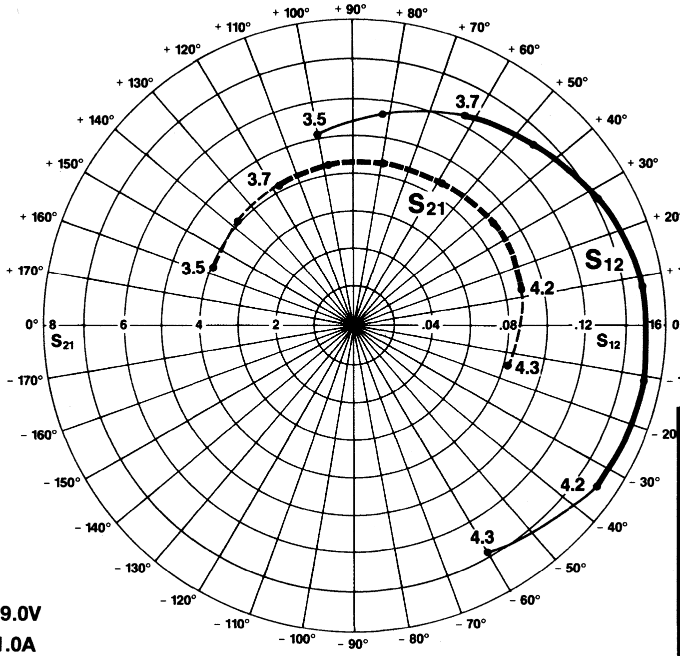
OUTPUT POWER (P_o) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 3.95 GHz, V_{DS} = 9.0V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} Mag	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
3.5	.23	-67.5	3.91	157.1	.106	99.8	.76	67.7
3.6	.20	−115.2	4.12	138.1	.115	82.3	.72	57.4
3.7	.20	−167.1	4.21	118.6	.126	64.1	.66	44.4
3.8	.24	152.9	4.27	99.5	.134	46.2	.60	34.5
3.9	.27	120.5	4.37	79.9	.142	28.3	.54	19.8
4.0	.27	85.3	4.46	59.6	.148	8.8	.48	5.5
4.1	.26	37.2	4.52	37.3	.152	−12.0	.43	−19.2
4.2	.31	−22.6	4.38	12.3	.151	-35.1	.39	−52.5
4.3	.44	-75.5	4.02	−14.6	.139	-60.6	.38	-94.4

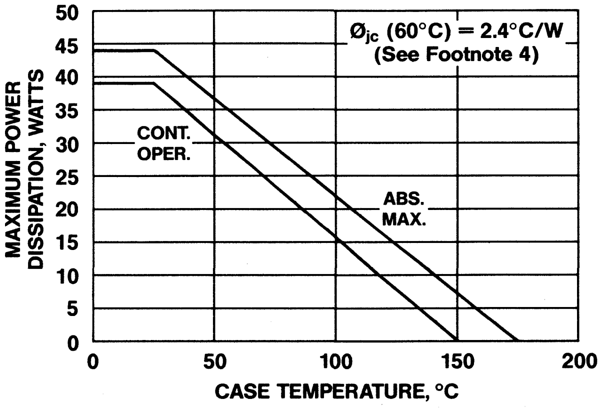
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	3.5	4.2	6.0
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	900	1400	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		2.0	2.4

RECOMMENDED MAXIMUM RATINGS

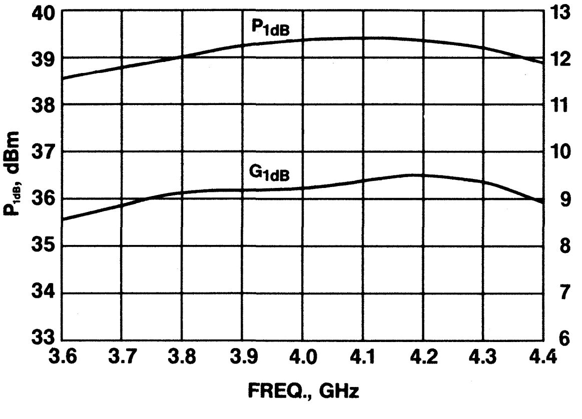
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	16V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	2.4A	I_{DSS}
Gate Current	I_G	20 mA	40 mA
DC Power Dissipation[8]	P_{DC}	39 W	44 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

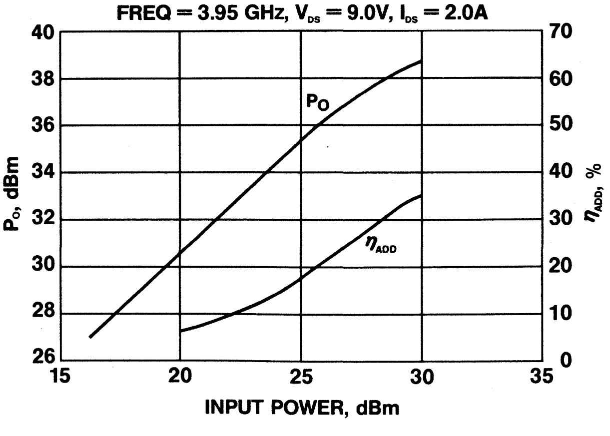


TYPICAL PERFORMANCE CURVES, T_A=25° C

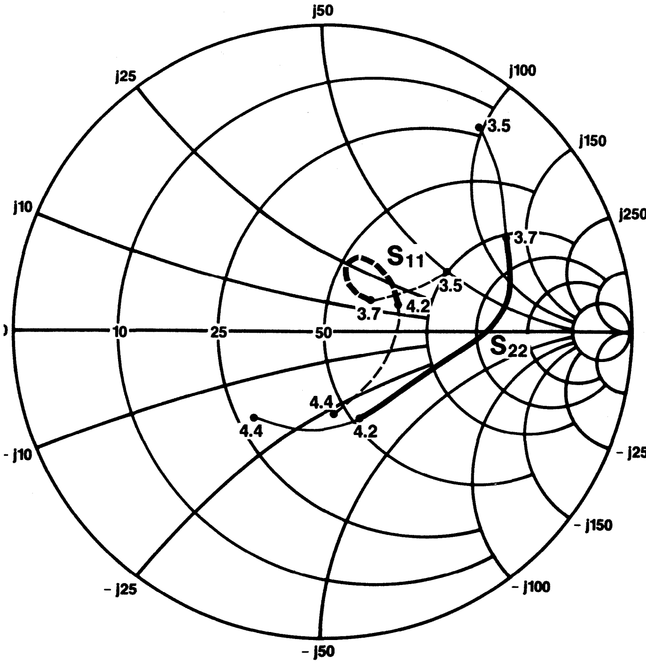
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



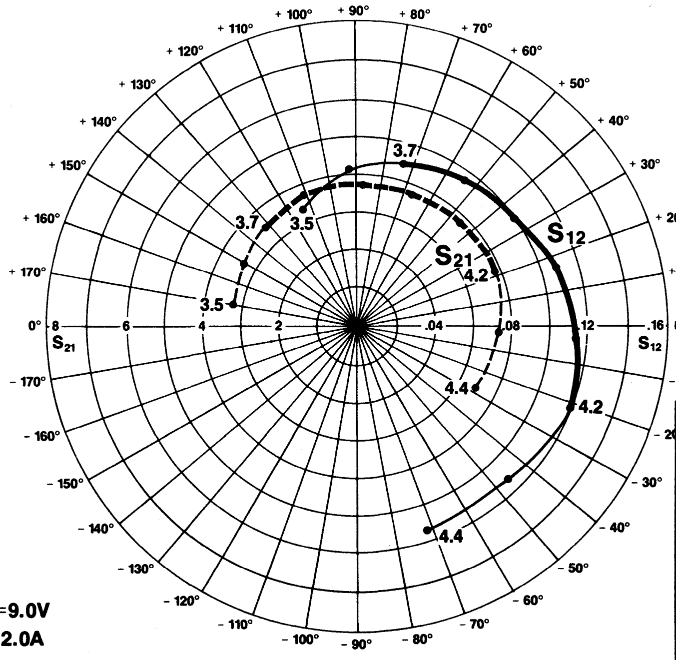
OUTPUT POWER (P_O) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER
FREQ = 3.95 GHz, V_{DS} = 9.0V, I_{DS} = 2.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=2.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 2.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
3.5	.43	29.5	3.17	169.6	.072	115.3	.83	55.1
3.6	.30	29.1	3.39	149.9	.083	93.3	.79	46.6
3.7	.18	36.3	3.54	130.5	.091	75.5	.64	29.5
3.8	.17	65.0	3.77	110.3	.098	55.3	.60	13.3
3.9	.24	74.9	3.78	87.6	.108	36.6	.51	-2.2
4.0	.28	68.9	3.76	68.3	.113	18.0	.41	-9.6
4.1	.28	52.8	3.87	46.4	.116	-3.6	.31	-36.5
4.2	.28	21.7	3.83	23.4	.122	-21.4	.31	-66.7
4.3	.25	-21.5	3.73	-1.0	.115	-47.1	.35	-94.6
4.4	.29	-82.4	3.45	-28.4	.118	-71.1	.39	-131.0

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \frac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}(60°C)\,[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. $T_{CASE} = 25°C$.

IM-4450-3/6
3 & 6 Watt, 4.4-5.0 GHz Internally Matched Power GaAs FET

FEATURES

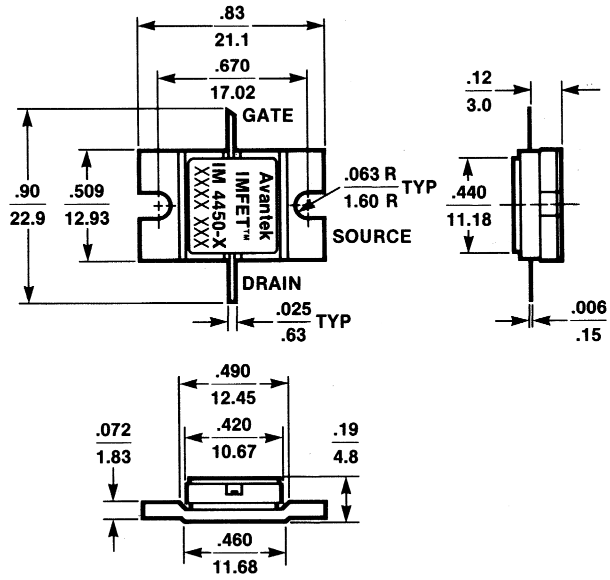
- **4.4-5.0 GHz Bandwidth**
- **Class A Operation**
- **Input and Output Internally Matched**
- **High Gain**
- **3 and 6 Watt Output Powers**
- **High Power Added Efficiency**
- **Hermetically Sealed Metal Ceramic Package**

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-4450 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3) and 20 mm for the 6 watt device (-6). The internal input and output matching circuits have been designed to optimize performance in the 4.4-5.0 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 4.4-5.0 GHz (unless otherwise specified)	Units	IM-4450-3 Min.	IM-4450-3 Typ.	IM-4450-3 Max.	IM-4450-6 Min.	IM-4450-6 Typ.	IM-4450-6 Max.
P_{1dB}	Output Power at 1 dB							
	$I_D \leq 1.2$ A	dBm	34.8	36				
	$I_D \leq 2.4$ A	dBm				37.8	38.5	
G_{1dB}	Gain at 1dB Compression Point							
	$I_D \leq 1.2$ A	dB	9	10.5				
	$I_D \leq 2.4$ A	dB				8	8.5	
η_{add}	Power Added Efficiency[1]							
	$I_D \leq 1.2$ A	%	30	35				
	$I_D \leq 2.4$ A	%				26	30	
VSWR	Small Signal Input VSWR[2]			2.0			2.0	

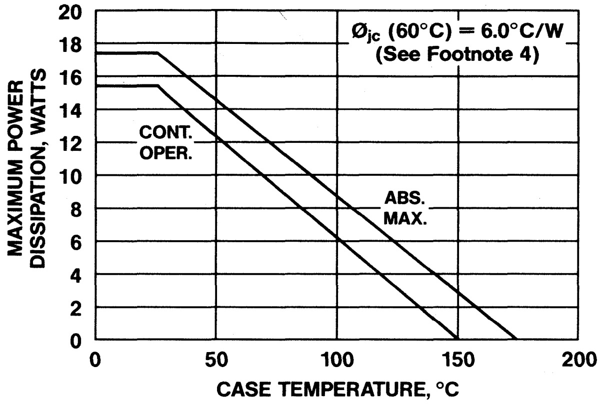
ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	-8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

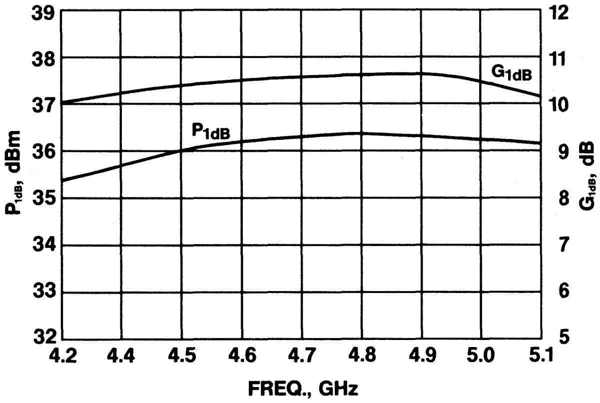
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

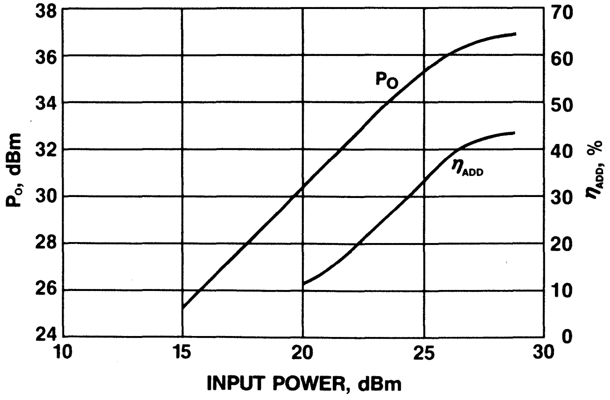


TYPICAL PERFORMANCE CURVES, T_A=25° C

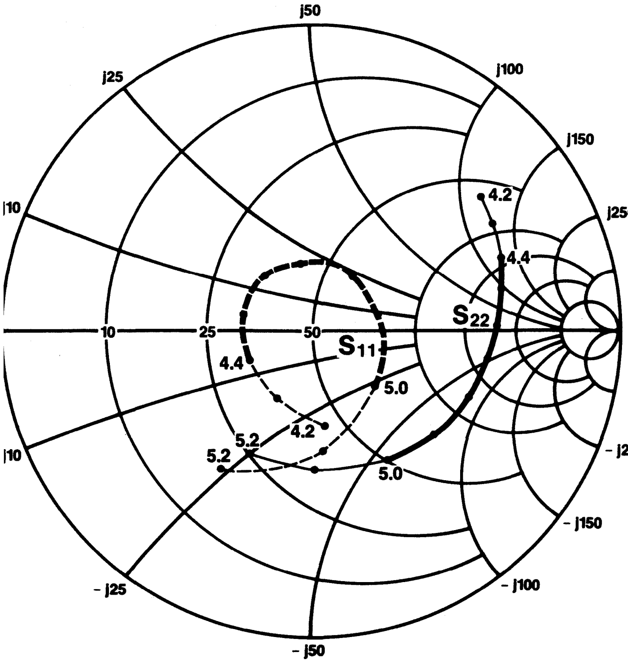
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



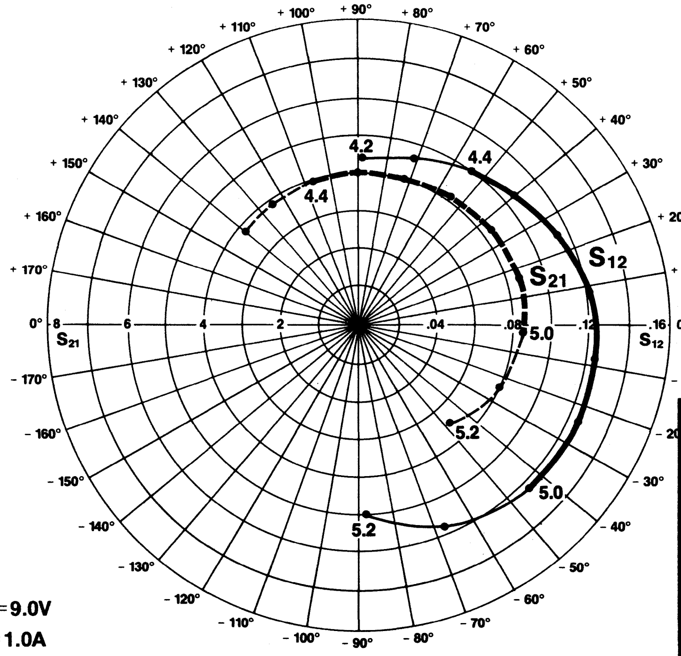
OUTPUT POWER (P_O) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 4.7 GHz, V_{DS} = 9V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} Mag	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
4.2	.31	-81.8	3.74	141.4	.088	89.7	.72	40.0
4.3	.25	-117.6	3.93	124.8	.096	73.3	.70	31.9
4.4	.22	-155.6	4.00	108.3	.102	56.8	.67	21.7
4.5	.23	165.2	4.08	91.4	.108	41.4	.64	13.2
4.6	.24	131.2	4.13	73.9	.114	25.8	.60	1.3
4.7	.23	100.5	4.20	56.8	.118	9.4	.57	-9.0
4.8	.22	63.4	4.21	38.4	.124	-7.6	.54	-22.9
4.9	.21	14.5	4.21	18.6	.126	-25.5	.51	-40.6
5.0	.26	-41.6	4.12	-1.8	.126	-45.8	.49	-61.3
5.1	.39	-86.3	3.87	-24.2	.120	-68.1	.46	-89.3
5.2	.54	-123.7	3.42	-48.2	.106	-88.6	.44	-116.7

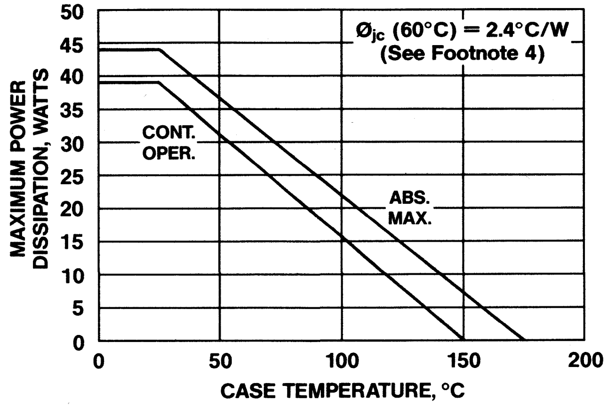
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	3.5	4.2	6.0
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	-8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	900	1400	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		2.0	2.4

RECOMMENDED MAXIMUM RATINGS

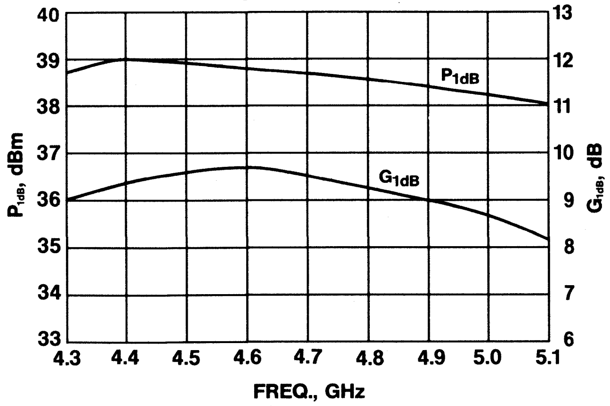
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	16V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	2.4A	I_{DSS}
Gate Current	I_G	20 mA	40 mA
DC Power Dissipation[8]	P_{DC}	39 W	44 W
Channel Temperature	T_{CH}	150° C	175° C
Storage Temperature	T_{STG}	- 65° C to 150° C	175° C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

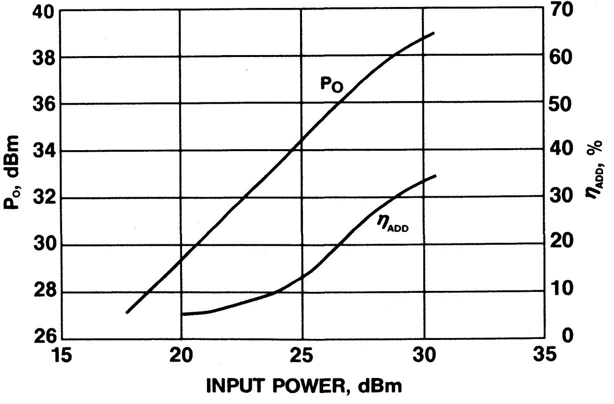


TYPICAL PERFORMANCE CURVES, T_A=25° C

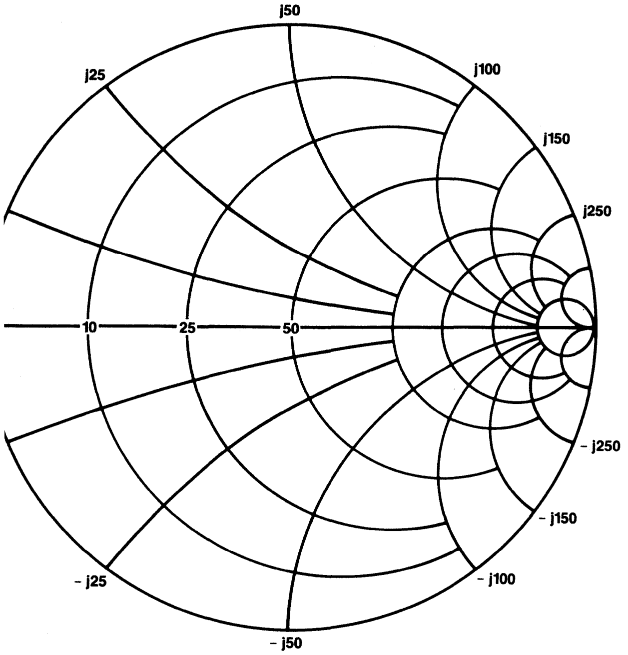
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



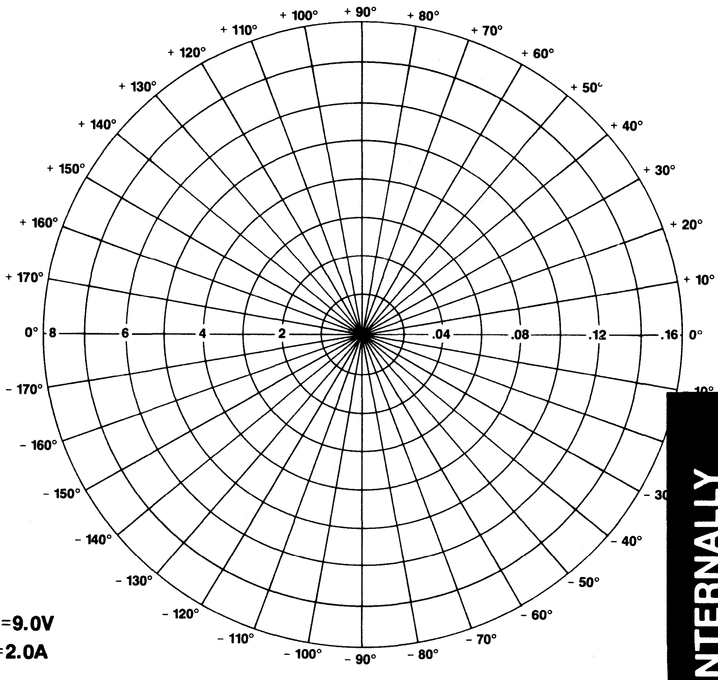
OUTPUT POWER (P_0) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER
FREQ = 4.7 GHz, V_{DS} = 9V, I_{DS} = 2.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=2.0A

DATA NOT AVAILABLE AT PRESS TIME!

PLEASE CONTACT FACTORY

TYPICAL SCATTERING PARAMETERS[5]

V_{DS}=9V, I_{DS}=2.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang

DATA NOT AVAILABLE AT PRESS TIME!

PLEASE CONTACT FACTORY

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \dfrac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}(60°C)\,[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and $\theta_{jc}(60°C)$ = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. $T_{CASE} = 25°C$.

IM-5459-3
3 Watt, 5.4-5.9 GHz Internally Matched Power GaAs FET

FEATURES

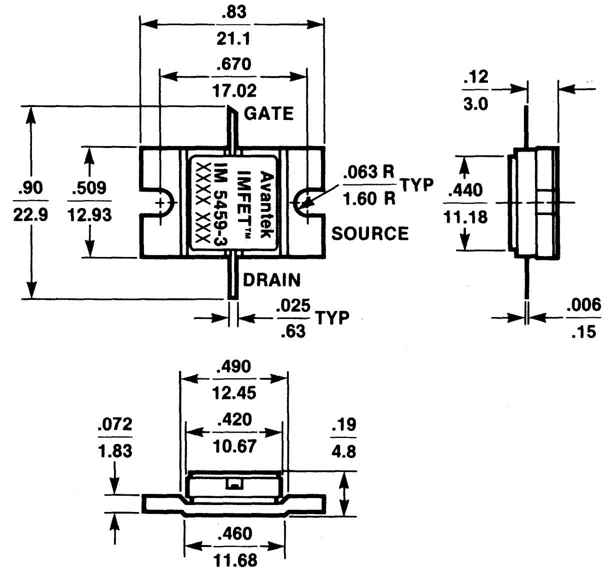
- 5.4-5.9 GHz Bandwidth
- Class A Operation
- Input and Output Internally Matched
- High Gain
- 3 Watt Output Power
- High Power Added Efficiency
- Hermetically Sealed Metal Ceramic Package

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-5459-3 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3). The internal input and output matching circuits have been designed to optimize performance in the 5.4-5.9 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 5.4-5.9 GHz (unless otherwise specified)	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1 dB $I_D \leq 1.2$ A	dBm	34.8	36.0	
G_{1dB}	Gain at 1dB Compression Point $I_D \leq 1.2$ A	dB	8.0	9.0	
ηadd	Power Added Efficiency[1] $I_D \leq 1.2$ A	% %	30	35	
VSWR	Small Signal Input VSWR[2]			2.0	

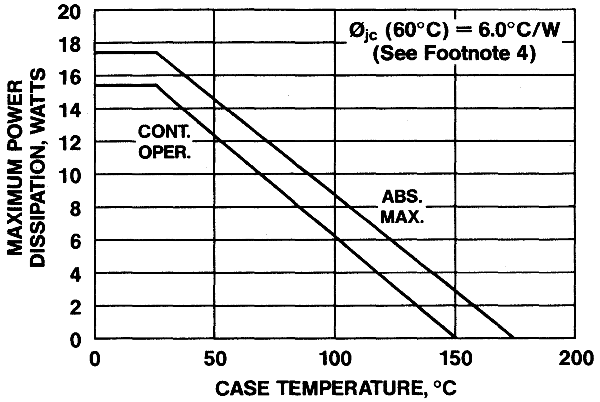
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

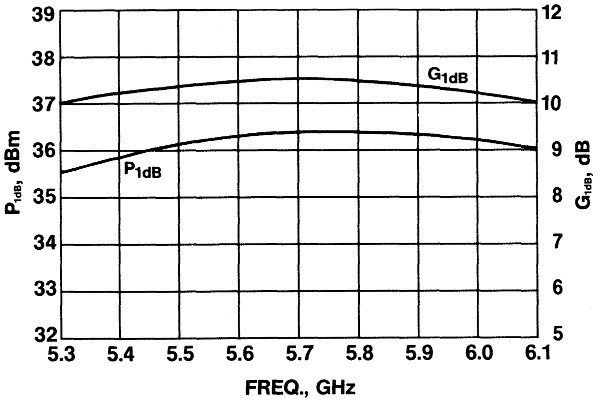
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

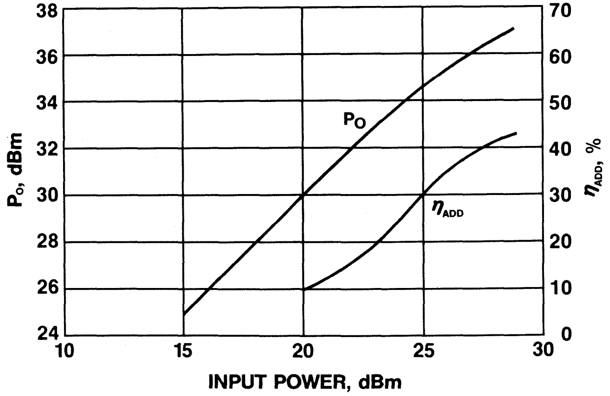


TYPICAL PERFORMANCE CURVES, T_A=25° C

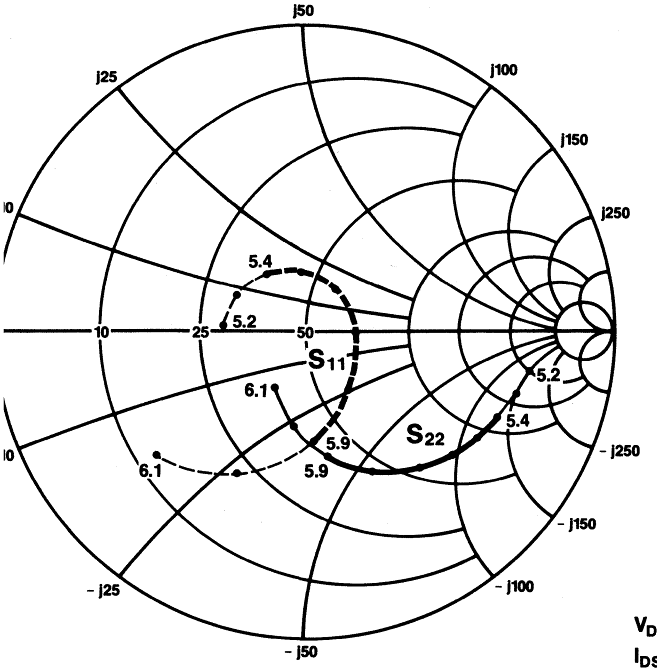
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



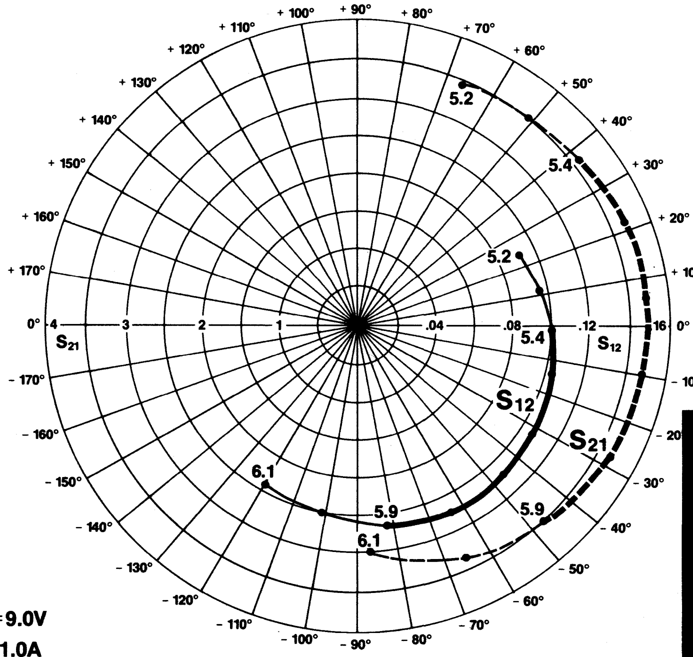
OUTPUT POWER (P_0) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 5.65 GHz, V_{DS} = 9V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} Mag	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
5.2	.26	176.5	3.46	66.9	.092	25.6	.75	-10.3
5.3	.25	152.5	3.52	52.3	.097	11.8	.72	-17.7
5.4	.23	123.7	3.58	38.3	.101	-2.3	.69	-25.4
5.5	.20	95.7	3.62	22.8	.105	-16.2	.66	-32.5
5.6	.16	57.2	3.72	6.6	.110	-31.3	.62	-43.0
5.7	.16	-.4	3.73	-9.6	.111	-47.3	.57	-51.7
5.8	.23	-53.1	3.71	-28.0	.111	-64.9	.50	-65.9
5.9	.36	-88.6	3.55	-47.6	.108	-82.9	.41	-79.3
6.0	.51	-117.4	3.34	-67.1	.100	-102.1	.30	-97.3
6.1	.63	-140.2	2.93	-86.9	.090	-120.4	.20	-118.6

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \dfrac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}\,(60°C)\ [1 + .00355\ (T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. $T_{CASE} = 25°C$.

IM-5964-3/6
3 & 6 Watt, 5.9-6.4 GHz
Internally Matched
Power GaAs FET

FEATURES

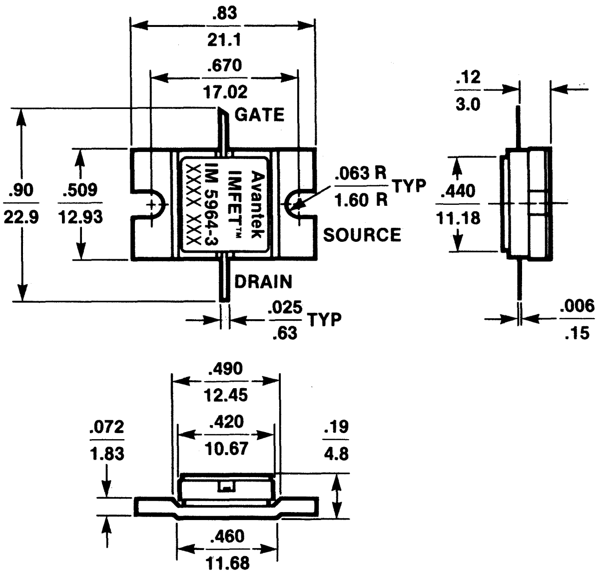
- **5.9-6.4 GHz Bandwidth**
- **Class A Operation**
- **Input and Output Internally Matched**
- **High Gain**
- **3 and 6 Watt Output Powers**
- **High Power Added Efficiency**
- **Hermetically Sealed Metal Ceramic Package**

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-5964 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3) and 20 mm for the 6 watt device (-6). The internal input and output matching circuits have been designed to optimize performance in the 5.9-6.4 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES. (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 5.9-6.4 GHz (unless otherwise specified)	Units	IM-5964-3 Min.	IM-5964-3 Typ.	IM-5964-3 Max.	IM-5964-6 Min.	IM-5964-6 Typ.	IM-5964-6 Max.
P_{1dB}	Output Power at 1 dB							
	$I_D \leq 1.2$ A	dBm	34.8	36.0				
	$I_D \leq 2.4$ A	dBm				37.8	38.5	
G_{1dB}	Gain at 1dB Compression Point							
	$I_D \leq 1.2$ A	dB	8.0	9.0				
	$I_D \leq 2.4$ A	dB				7.0	7.5	
η_{add}	Power Added Efficiency[1]							
	$I_D \leq 1.2$ A	%	30	35				
	$I_D \leq 2.4$ A	%				26	30	
VSWR	Small Signal Input VSWR[2]			2.0			2.0	

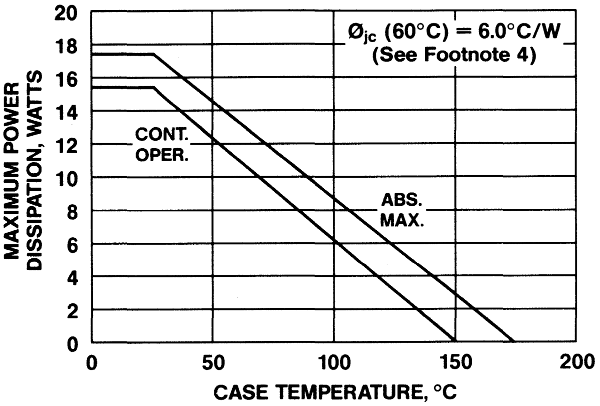
ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

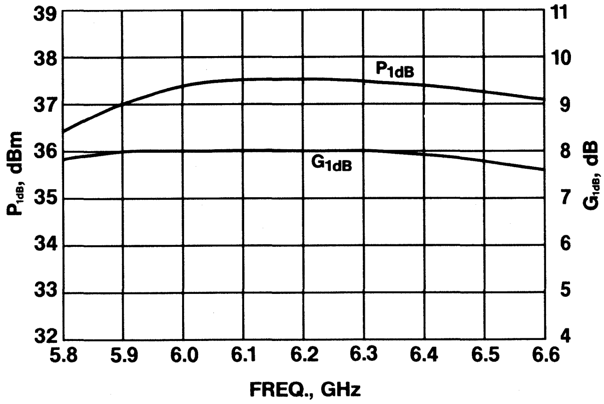
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

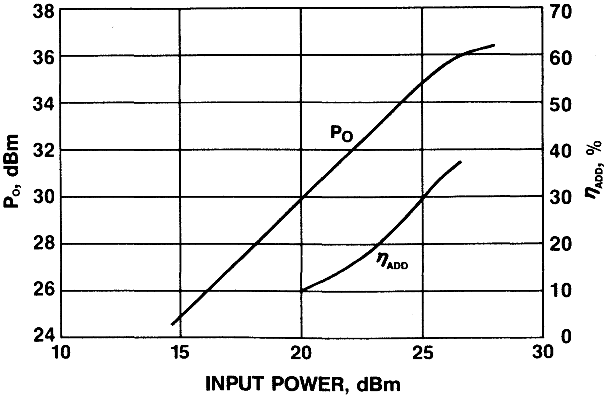


TYPICAL PERFORMANCE CURVES, T_A=25° C

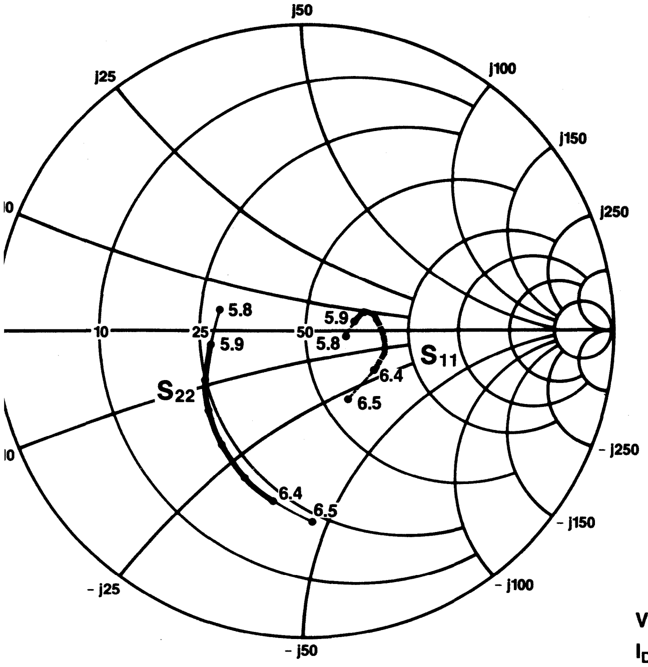
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



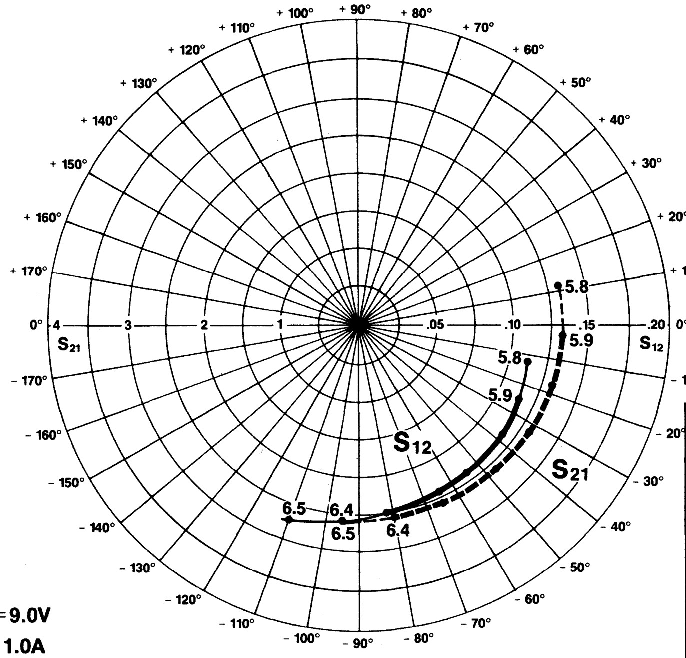
OUTPUT POWER (P_O) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 6.15 GHz, V_{DS} = 9.0V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
5.8	.13	-6.3	2.81	12.6	.112	-11.3	.62	-88.6
5.9	.15	9.3	2.84	-3.1	.115	-26.0	.58	-101.2
6.0	.19	17.9	2.87	-17.8	.119	-39.2	.50	-111.4
6.1	.23	9.3	2.87	-33.7	.121	-54.2	.46	-125.0
6.2	.25	-.9	2.85	-48.5	.124	-66.7	.39	-138.2
6.3	.27	-16.2	2.85	-65.6	.130	-82.2	.36	-153.3
6.4	.25	-32.1	2.80	-79.9	.129	-95.1	.30	-172.1
6.5	.26	-59.1	2.83	-96.6	.135	-110.1	.28	165.8

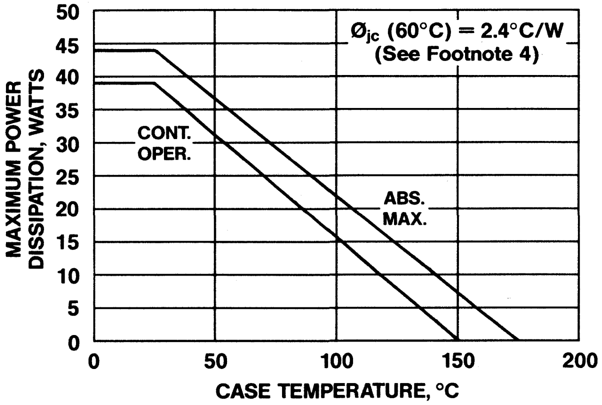
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	3.5	4.2	6.0
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	900	1400	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		2.0	2.4

RECOMMENDED MAXIMUM RATINGS

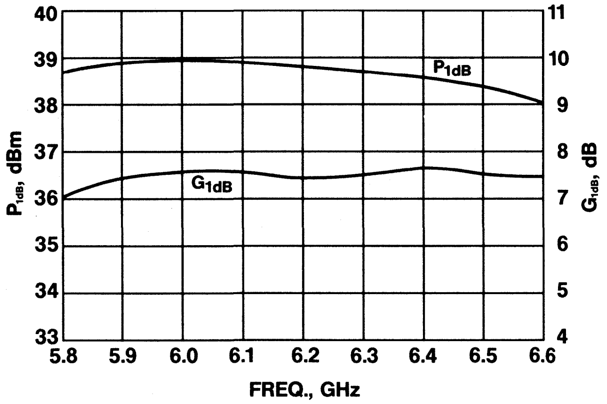
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	16V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	2.4A	I_{DSS}
Gate Current	I_G	20 mA	40 mA
DC Power Dissipation[8]	P_{DC}	39 W	44 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

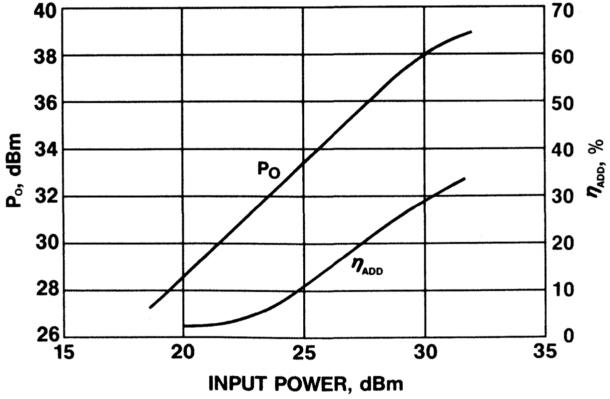


TYPICAL PERFORMANCE CURVES, T_A=25° C

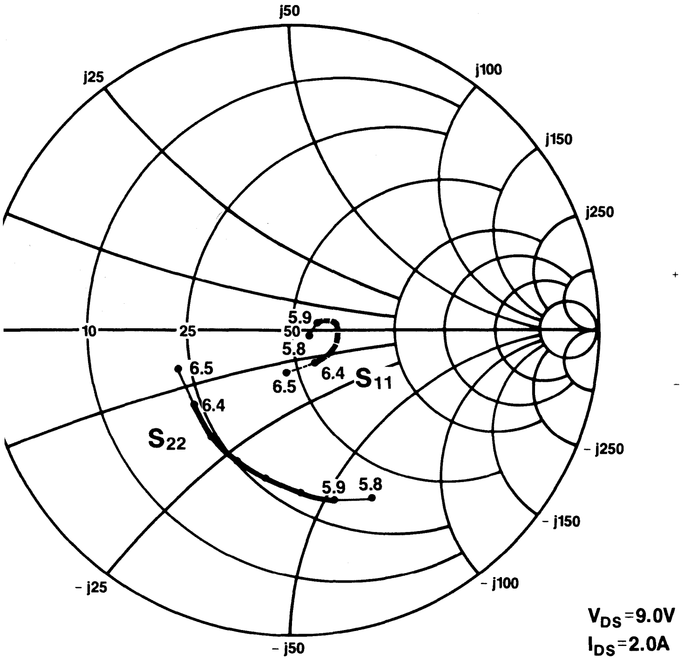
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



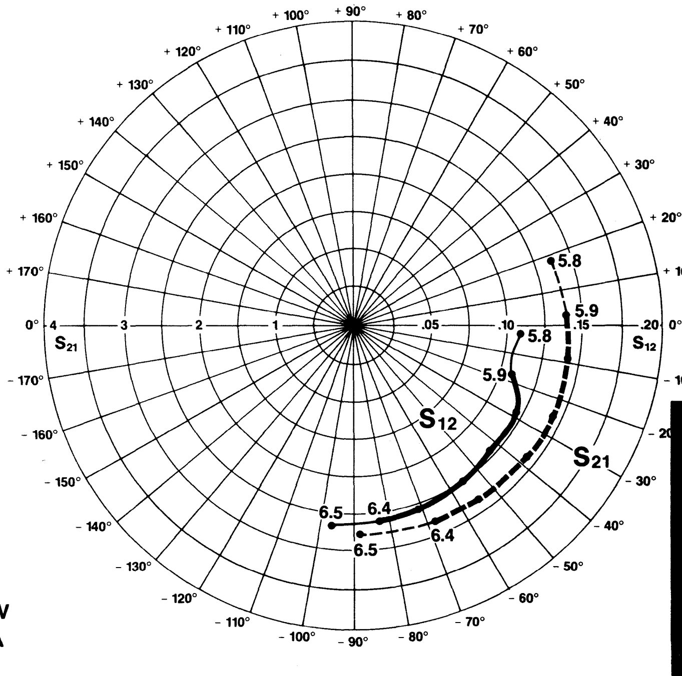
OUTPUT POWER (P_o) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER
FREQ = 6.15 GHz, V_{DS} = 9.0V, I_{DS} = 2.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 2.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
5.8	.06	-12.8	2.72	19.4	.113	-3.3	.63	-63.9
5.9	.09	12.9	2.77	4.4	.116	-17.2	.60	-76.2
6.0	.11	20.6	2.79	-9.4	.121	-29.9	.53	-86.6
6.1	.14	10.5	2.80	-24.2	.122	-44.2	.51	-99.2
6.2	.15	-4.5	2.80	-38.7	.126	-55.6	.46	-111.8
6.3	.14	-25.6	2.81	-55.0	.130	-71.1	.44	-125.7
6.4	.13	-52.9	2.77	-68.8	.130	-83.0	.39	-141.3
6.5	.14	-94.4	2.80	-85.2	.134	-96.9	.39	-160.0

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \frac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with V_{DS} = 1.5 volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}(60°C)\,[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. T_{CASE} = 25°C.

IM-6471-3
3 Watt, 6.4-7.1 GHz Internally Matched Power GaAs FET

FEATURES

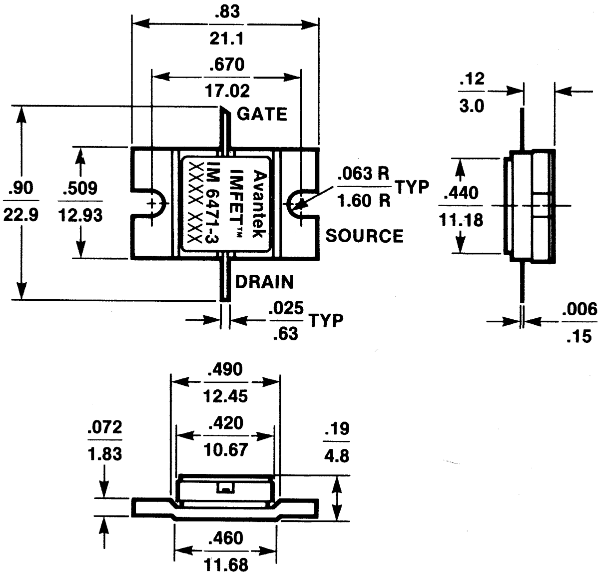
- **6.4-7.1 GHz Bandwidth**
- **Class A Operation**
- **Input and Output Internally Matched**
- **High Gain**
- **3 Watt Output Power**
- **High Power Added Efficiency**
- **Hermetically Sealed Metal Ceramic Package**

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-6471-3 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3). The internal input and output matching circuits have been designed to optimize performance in the 6.4–7.1 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES. (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 6.4-7.1 GHz (unless otherwise specified)	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1 dB $I_D \leq 1.2$ A	dBm	34.8	36.0	
G_{1dB}	Gain at 1dB Compression Point $I_D \leq 1.2$ A	dB	7.0	8.0	
η_{add}	Power Added Efficiency[1] $I_D \leq 1.2$ A	%	30	35	
VSWR	Small Signal Input VSWR[2]			2.0	

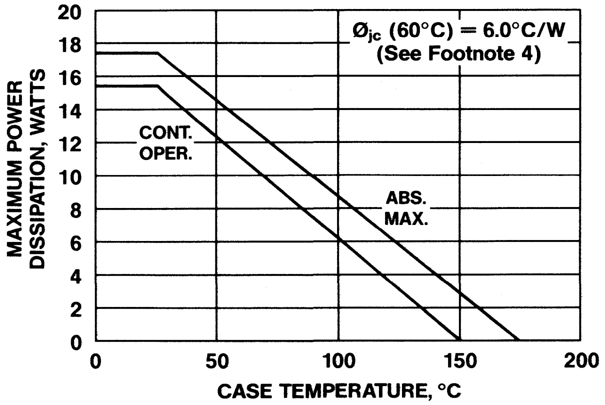
ELECTRICAL SPECIFICATIONS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

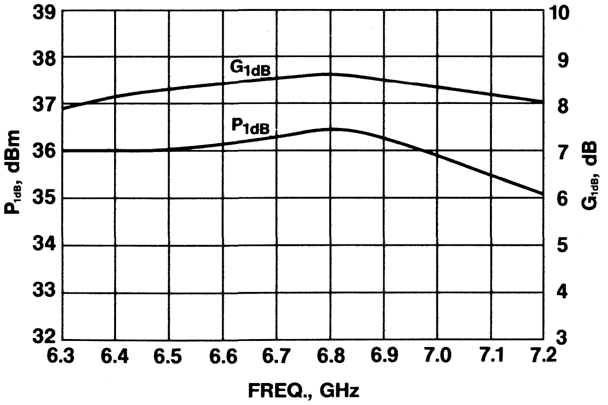
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

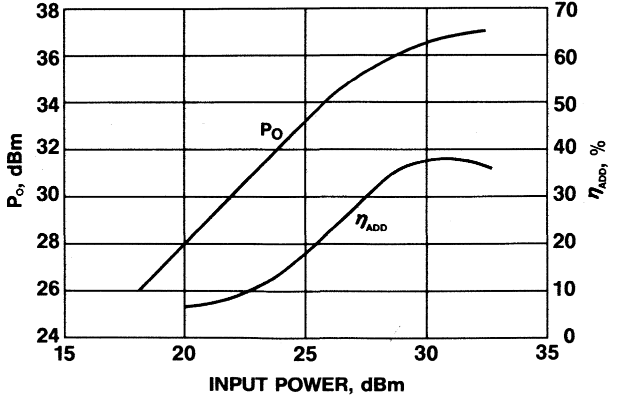


TYPICAL PERFORMANCE CURVES, T_A=25° C

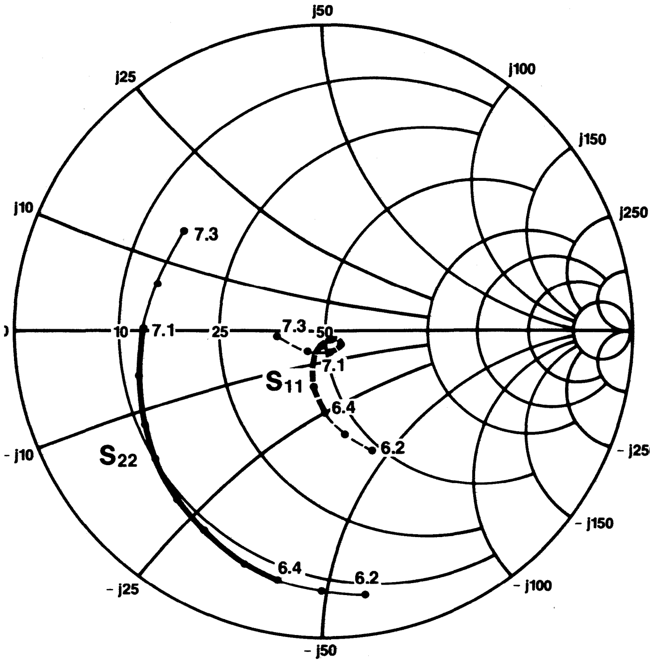
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



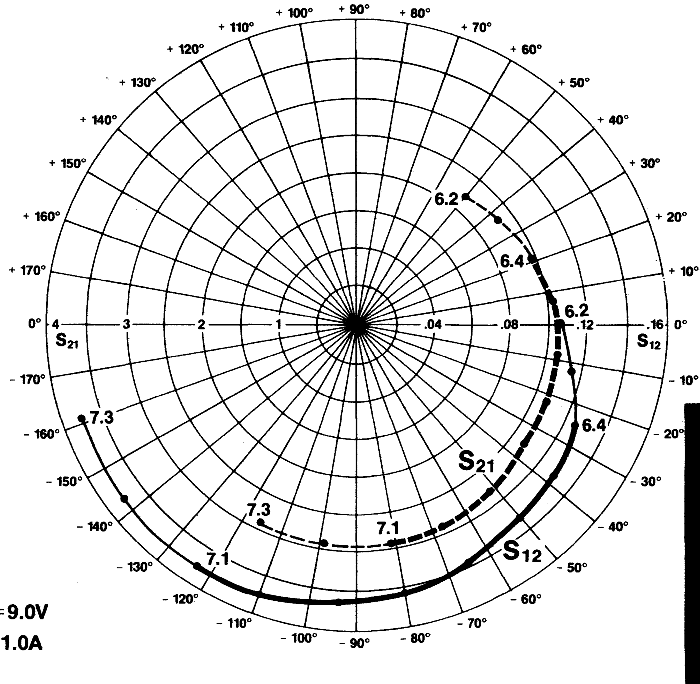
OUTPUT POWER (P_0) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 6.75 GHz, V_{DS} = 9V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
6.2	.44	-67.7	2.21	50.7	.105	1.4	.90	-80.9
6.3	.36	-77.8	2.34	36.8	.115	-11.6	.88	-90.2
6.4	.27	-88.2	2.47	22.3	.123	-25.4	.85	-99.9
6.5	.19	-97.2	2.58	8.1	.130	-38.7	.82	-108.4
6.6	.11	-98.9	2.61	-7.3	.135	-52.4	.77	-120.5
6.7	.05	-93.7	2.68	-22.1	.140	-66.2	.74	-129.3
6.8	.04	-42.1	2.72	-36.7	.145	-80.1	.69	-141.7
6.9	.06	-22.8	2.77	-51.9	.148	-94.3	.65	-150.9
7.0	.06	-30.5	2.79	-66.9	.149	-109.5	.62	-166.0
7.1	.07	-69.2	2.80	-82.8	.151	-125.5	.58	-179.1
7.2	.08	-125.5	2.79	-99.7	.150	-143.4	.57	163.5
7.3	.14	-174.4	2.72	-118.4	.145	-162.7	.56	142.5

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \dfrac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}\,(60°C)\,[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. $T_{CASE} = 25°C$.

IM-7178-3
3 Watt, 7.1-7.8 GHz Internally Matched Power GaAs FET

FEATURES

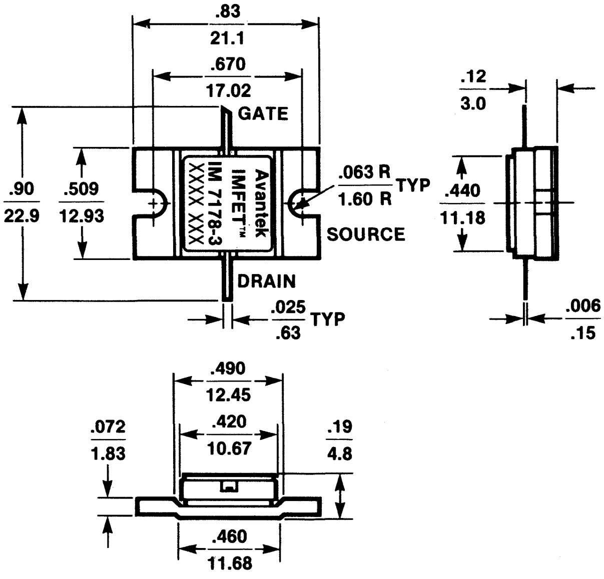
- 7.1-7.8 GHz Bandwidth
- Class A Operation
- Input and Output Internally Matched
- High Gain
- 3 Watt Output Power
- High Power Added Efficiency
- Hermetically Sealed Metal Ceramic Package

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-7178-3 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3). The internal input and output matching circuits have been designed to optimize performance in the 7.1-7.8 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$

2. TOLERANCES $\frac{\text{.XX} \pm \text{.02} \quad \text{.XXX} \pm \text{.010}}{\text{.X} \pm \text{.05} \quad \text{.XX} \pm \text{.25}}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 7.1-7.8 GHz (unless otherwise specified)	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1 dB $I_D \leq 1.2$ A	dBm	34.8	36.0	
G_{1dB}	Gain at 1dB Compression Point $I_D \leq 1.2$ A	dB	6.0	7.5	
η_{add}	Power Added Efficiency[1] $I_D \leq 1.2$ A	%	30	35	
VSWR	Small Signal Input VSWR[2]			2.0	

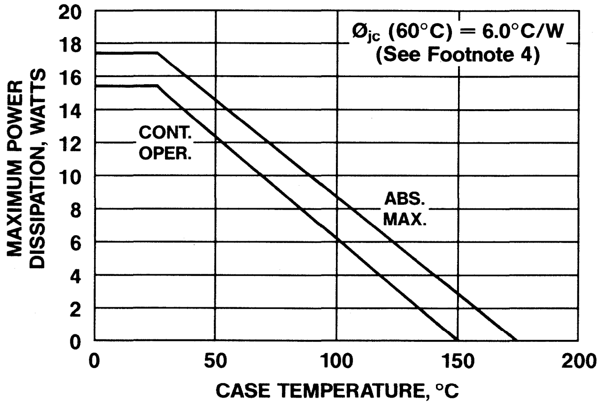
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

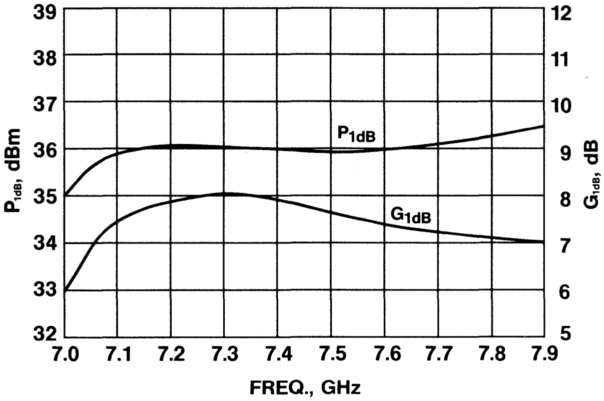
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

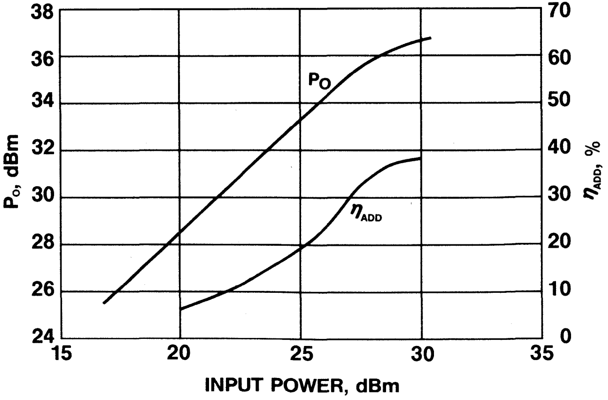


TYPICAL PERFORMANCE CURVES, T_A=25° C

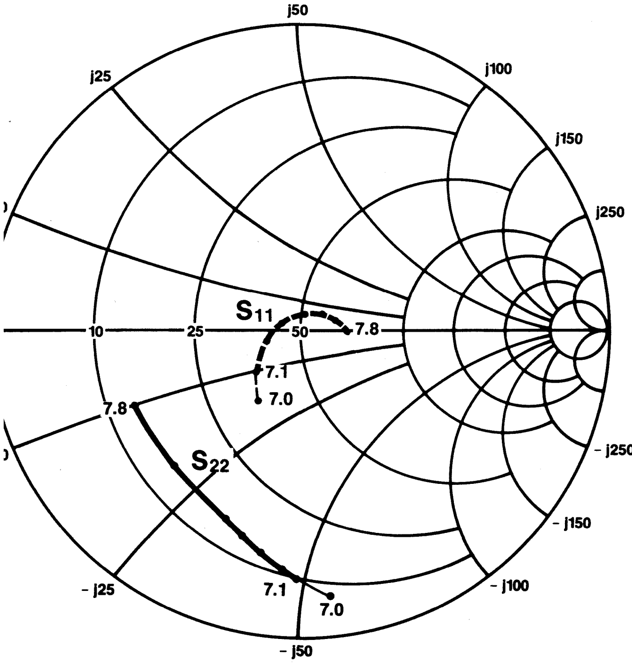
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



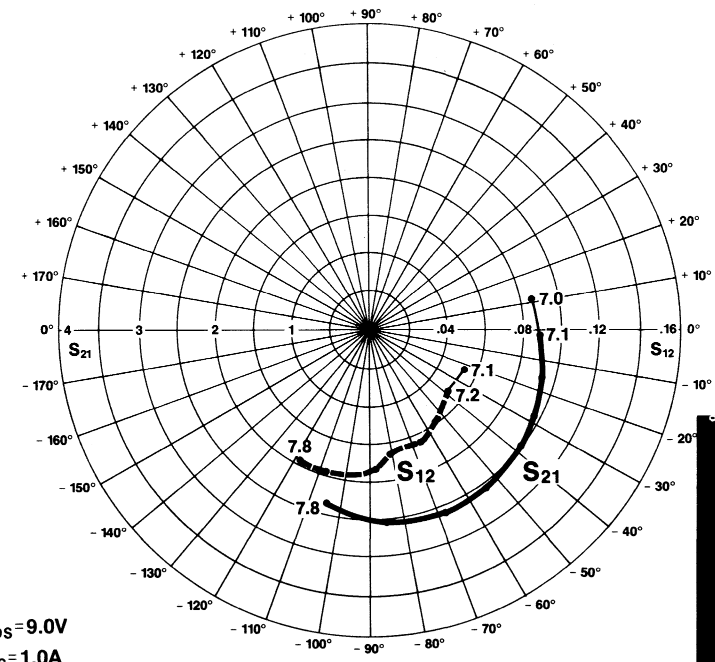
OUTPUT POWER (P_0) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 7.45 GHz, V_{DS} = 9V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS}=9.0V
I_{DS}=1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq.	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
7.0	.26	-120.6	2.18	11.2	.070	-22.3	.89	-84.5
7.1	.19	-138.0	2.24	-1.5	.067	-39.4	.83	-91.9
7.2	.11	-165.9	2.35	-14.5	.075	-54.4	.81	-95.6
7.3	.07	151.4	2.42	-28.3	.084	-65.6	.74	-100.2
7.4	.05	89.0	2.48	-40.0	.072	-81.3	.70	-106.6
7.5	.09	45.7	2.55	-54.4	.098	-84.3	.66	-111.3
7.6	.09	39.1	2.72	-69.2	.093	-107.2	.69	-114.9
7.7	.11	25.6	2.64	-86.9	.080	-118.6	.60	-134.0
7.8	.19	0	2.33	-105.0	.037	-119.2	.59	-156.2

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \frac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$
2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.
3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.
4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}\,(60°C)\;[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.
6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.
7. Operation of this device above any one of these parameters may cause permanent damage.
8. $T_{CASE} = 25°C$.

IM-7984-3
3 Watt, 7.9-8.4 GHz Internally Matched Power GaAs FET

FEATURES

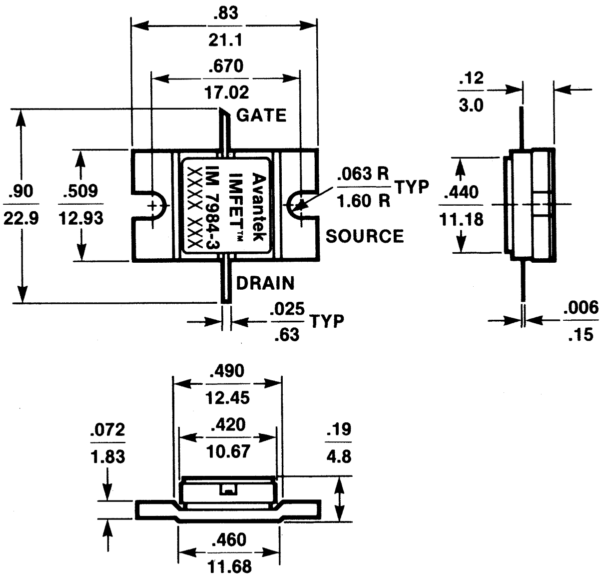
- 7.9-8.4 GHz Bandwidth
- Class A Operation
- Input and Output Internally Matched
- High Gain
- 3 Watt Output Power
- High Power Added Efficiency
- Hermetically Sealed Metal Ceramic Package

DESCRIPTION

Each Avantek IMFET™ internally matched GaAs FET delivers high power output and power added efficiency plus high gain. When used in a 50 ohm system, no external tuning is required to achieve all guaranteed specifications. All matching circuits are fabricated on thin-film substrates and use no lumped devices.

The IM-7984-3 uses Avantek 0.5 μm GaAs FET chips with a gate periphery of 10 mm for the 3 watt device (-3). The internal input and output matching circuits have been designed to optimize performance in the 7.9-8.4 GHz frequency band. High reliability is assured by the use of a gold-based refractory metal system, silicon nitride passivation, and hermetic packaging combined with Avantek's stringent quality assurance and testing program.

Avantek IMFET™ Package



NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES $\frac{.XX \pm .02 \quad .XXX \pm .010}{.X \pm .05 \quad .XX \pm .25}$

RF PERFORMANCE SPECIFICATIONS, $T_A = 25°C$

Symbol	Parameters: Test Conditions V_{DS} = 9V, f = 7.9-8.4 GHz (unless otherwise specified)	Units	Min.	Typ.	Max.
P_{1dB}	Output Power at 1 dB $I_D \leq 1.2$ A	dBm	34.8	36.6	
G_{1dB}	Gain at 1dB Compression Point $I_D \leq 1.2$ A	dB	6.0	7.0	
η_{add}	Power Added Efficiency[1] $I_D \leq 1.2$ A	%	30		
VSWR	Small Signal Input VSWR[2]			2.0	

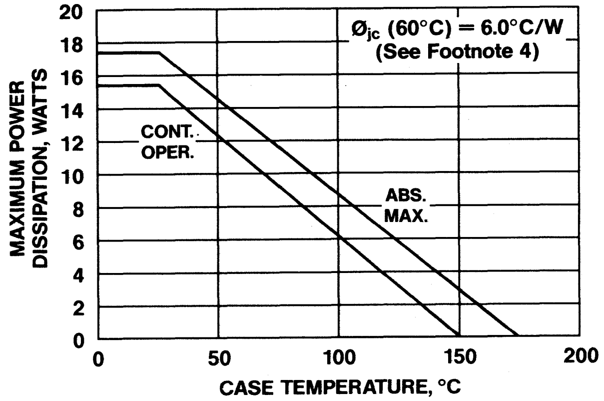
ELECTRICAL CHARACTERISTICS, T_A = 25°C

Symbol	Parameters: Test Conditions	Units	Min.	Typ.	Max.
I_{DSS}	Saturated Drain Current: V_{DS} = 3V, V_{GS} = 0V	amps	1.8	2.4	3.5
V_P	Pinchoff Voltage: V_{DS} = 3V, I_{DS} = 10 mA	volts	−1.7	−3.0	−6.0
BV_{GSO}	Breakdown Voltage, Gate-Source: V_{DS} = 0V, I_{GS} = 1 mA	volts	−8	−14	
g_m	Transconductance: V_{DS} = 3V, I_{DS} = I_{DSS}	mmho	500	800	
θ_{jc}	Thermal Resistance, Channel-to-Case:[3] T_{CH} = 60°C	°C/W		5.5	6.0

RECOMMENDED MAXIMUM RATINGS

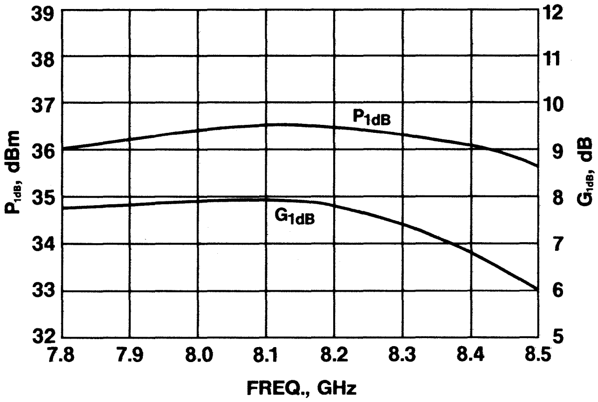
Parameter	Symbol	Cont.[6] Oper.	Abs.[7] Max.
Drain-Source Voltage	V_{DS}	9V	20V
Gate-Source Voltage	V_{GS}	-5V	-7V
Drain Current	I_{DS}	1.2A	I_{DSS}
Gate Current	I_G	10 mA	20 mA
DC Power Dissipation[8]	P_{DC}	15.5 W	17.5 W
Channel Temperature	T_{CH}	150°C	175°C
Storage Temperature	T_{STG}	- 65°C to 150°C	175°C

MAXIMUM POWER DISSIPATION vs. CASE TEMPERATURE

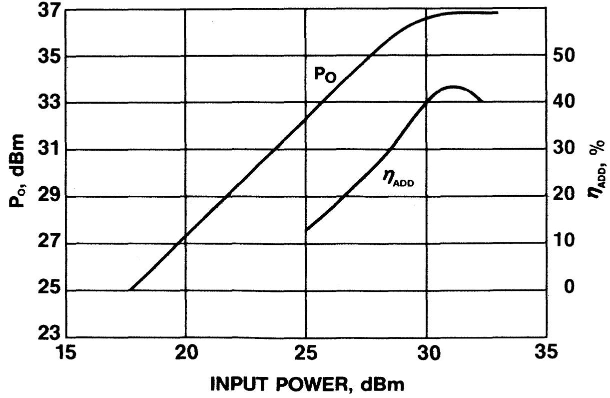


TYPICAL PERFORMANCE CURVES, T_A=25° C

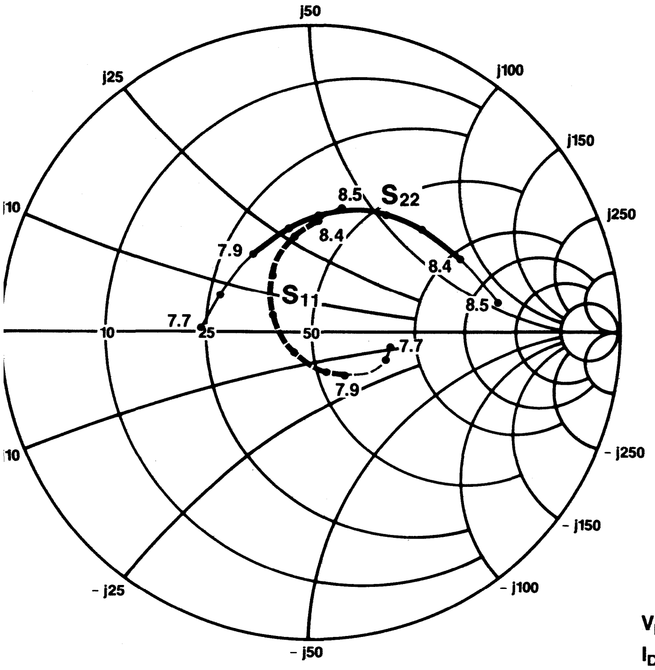
POWER OUTPUT @ 1dB GAIN COMPRESSION vs. FREQUENCY



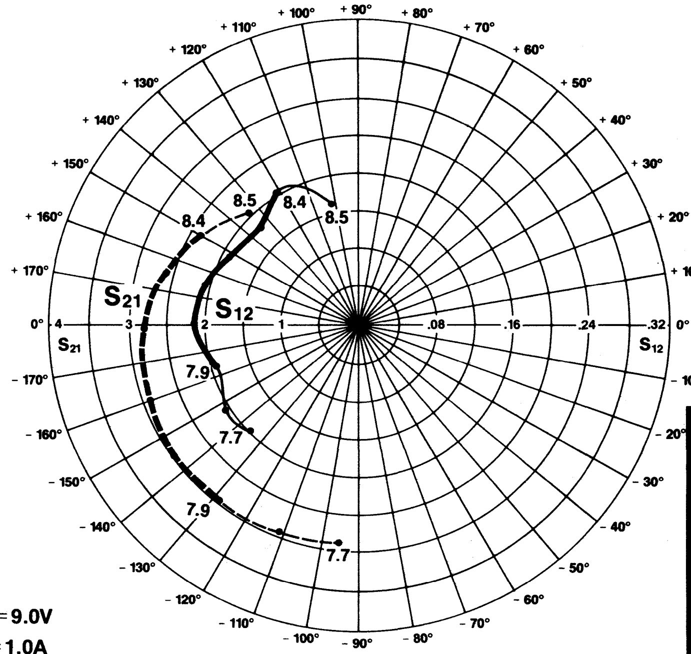
OUTPUT POWER (P_O) AND POWER ADDED EFFICIENCY (η_{ADD}) vs. INPUT POWER FREQ = 8.15 GHz, V_{DS} = 9V, I_{DS} = 1.0A



INPUT REFLECTION COEFFICIENT (S_{11}) AND OUTPUT REFLECTION COEFFICIENT (S_{22}) vs FREQUENCY



FORWARD TRANSMISSION COEFFICIENT (S_{21}) AND REVERSE TRANSMISSION COEFFICIENT (S_{12}) vs. FREQUENCY



V_{DS} = 9.0V
I_{DS} = 1.0A

TYPICAL SCATTERING PARAMETERS[5]

V_{DS} = 9V, I_{DS} = 1.0 A

Freq. GHz	S_{11} Mag	S_{11} Ang	S_{21} Mag	S_{21} Ang	S_{12} Mag	S_{12} Ang	S_{22} Mag	S_{22} Ang
7.7	.27	-9.2	2.92	-95.2	.150	-136.2	.35	175.7
7.8	.26	-19.6	2.92	-111.0	.171	-147.7	.31	156.2
7.9	.17	-47.3	2.96	-128.6	.148	-163.1	.33	124.7
8.0	.13	-65.0	2.91	-143.7	.165	-179.8	.36	111.6
8.1	.07	-123.8	2.83	-160.5	.163	166.1	.38	87.1
8.2	.12	150.9	2.74	-177.5	.141	152.5	.46	58.1
8.3	.22	122.1	2.50	166.7	.152	134.6	.55	47.6
8.4	.32	98.2	2.32	148.5	.162	121.2	.55	26.5
8.5	.42	83.9	2.04	133.5	.118	102.0	.64	9.3

IMFET DATA SHEET FOOTNOTES

1. $\eta_{ADD} = \frac{P_{OUT} - P_{IN}}{V_{DS} \times I_{DS}} \times 100\%$

2. VSWR is measured in Avantek test fixture IMTF-1. Test fixtures are available. Data sheet available upon request.

3. Thermal resistance is measured with a Sage Theta 220A tester (5-amp version) with $V_{DS} = 1.5$ volts.

4. The thermal resistance from channel to case is a function of temperature and varies directly as the thermal resistance of bulk GaAs. This temperature variation can be approximated by

   $\theta_{jc} = \theta_{jc}(60°C)\,[1 + .00355\,(T_{CH} - 60°)]$

   where T_{CH} = channel temperature and θ_{jc} (60°C) = channel-to-case thermal resistance at a T_{CH} of 60°C.

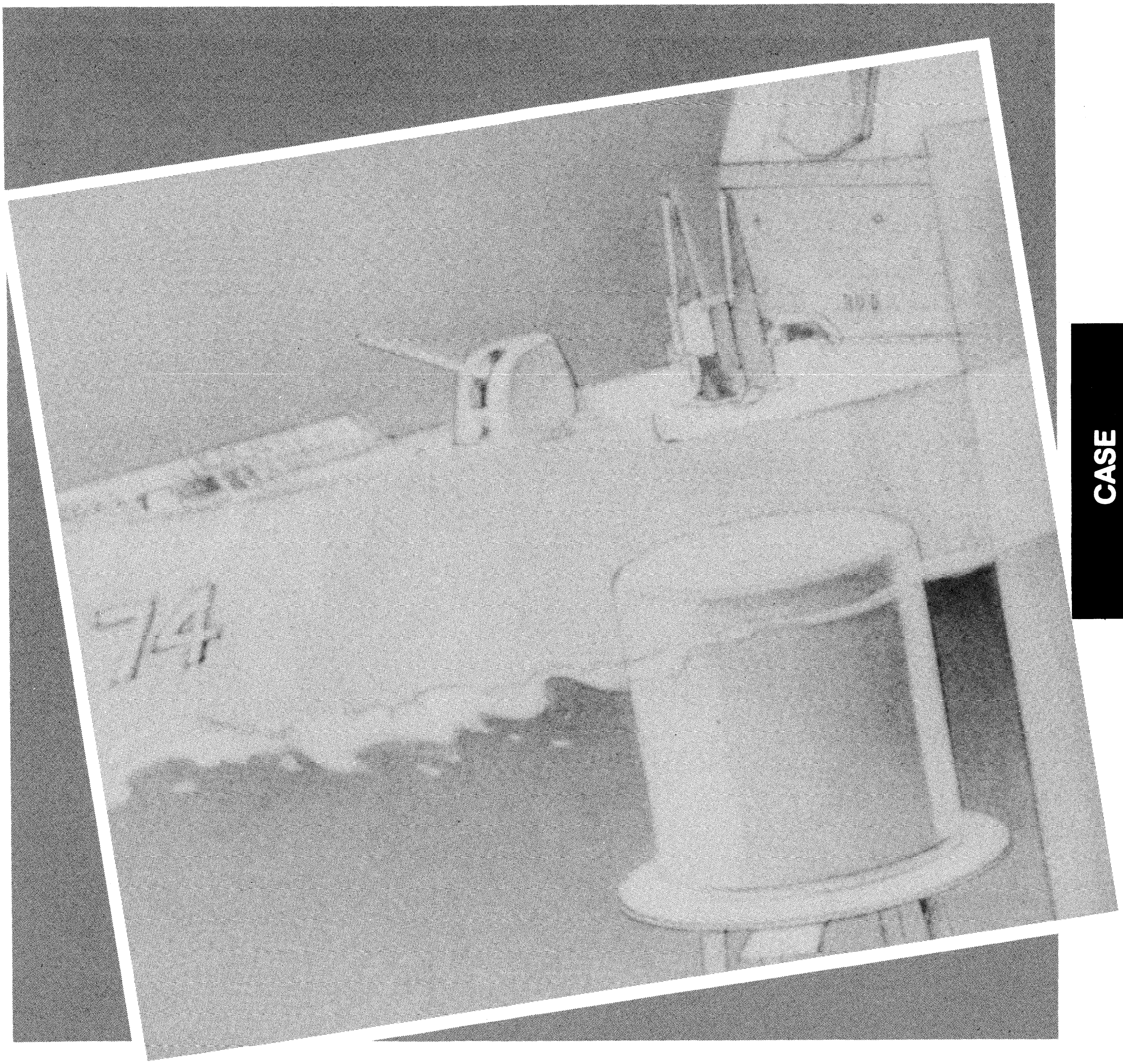
5. S parameters are measured in Avantek test fixture IMTF-2 with special calibration lines and error-correcting subroutines. Reference planes for the S parameters are at the outside ceramic surface of the package.

6. Operation of this device above any one of these parameters may shorten the MTTF from the design goals.

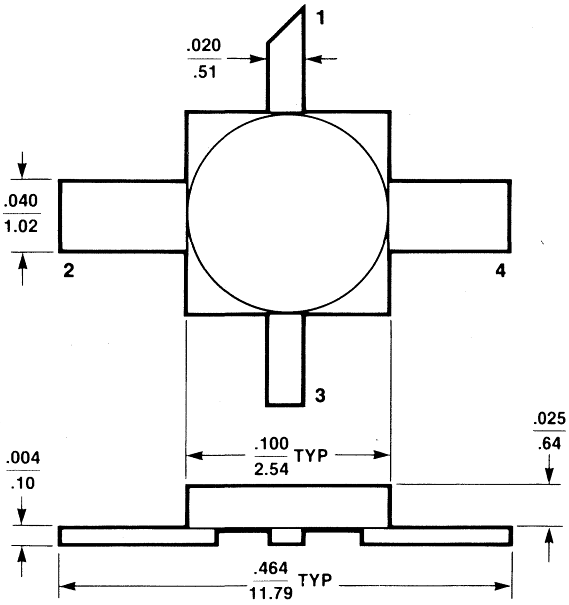
7. Operation of this device above any one of these parameters may cause permanent damage.

8. $T_{CASE} = 25°C$.

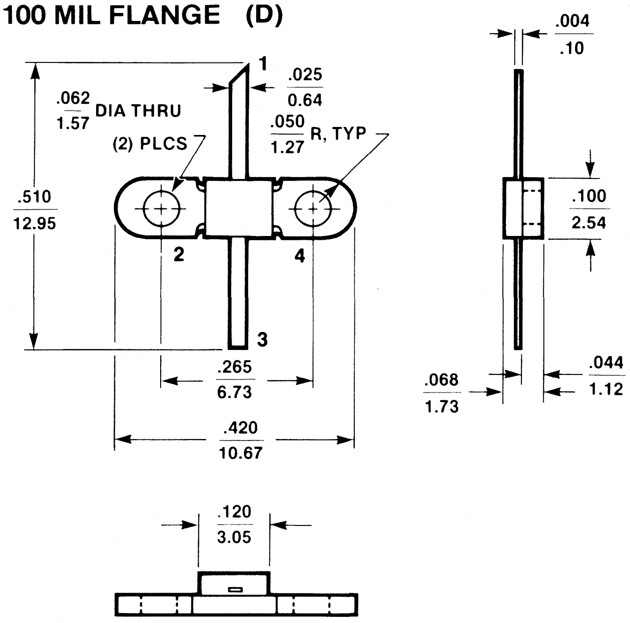
Case Drawings



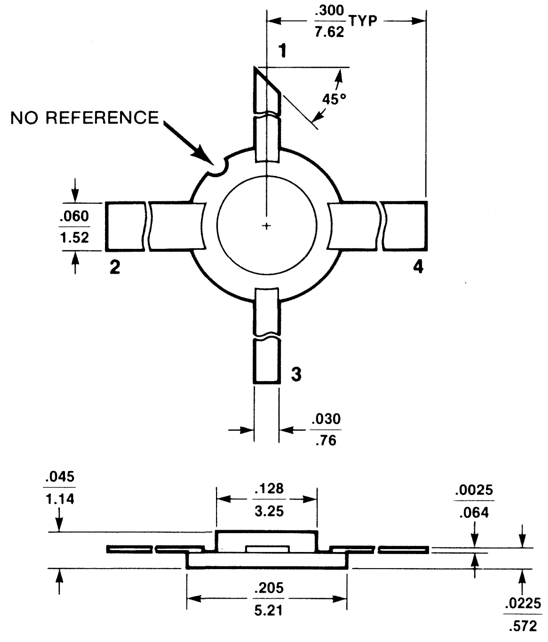
100 MIL STRIPLINE (A)



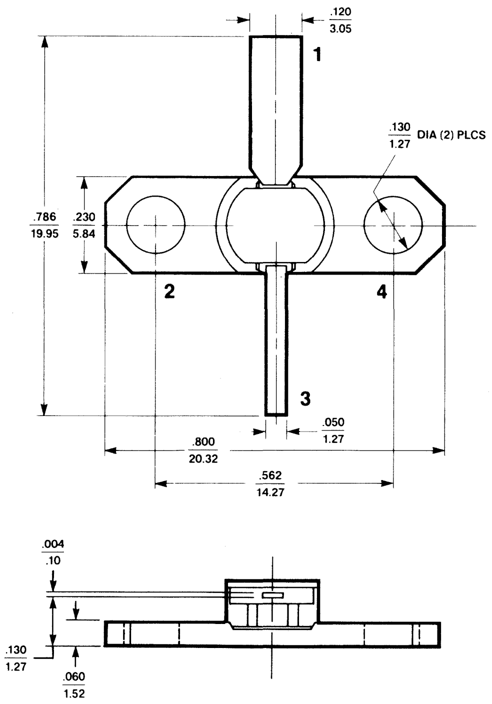
100 MIL FLANGE (D)



200 MIL STRIPLINE (A, C)



230 MIL FLANGE (A)

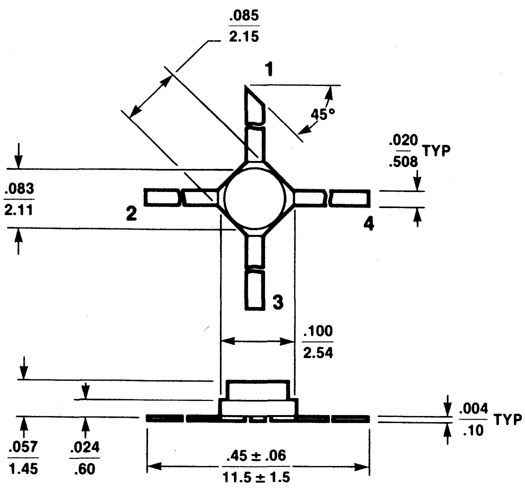


	LEAD	1	2	3	4
A	SILICON BIPOLAR TRANSISTORS	BASE	EMITTER	COLLECTOR	EMITTER
B	MODAMP™ SINGLE GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT	BIAS
C	MODAMP™ DUAL GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT AND BIAS	GROUND
D	DISCRETE AND MATCHED GaAs FETs	GATE	SOURCE	DRAIN	SOURCE

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

MICRO-X (A, B, C, D)



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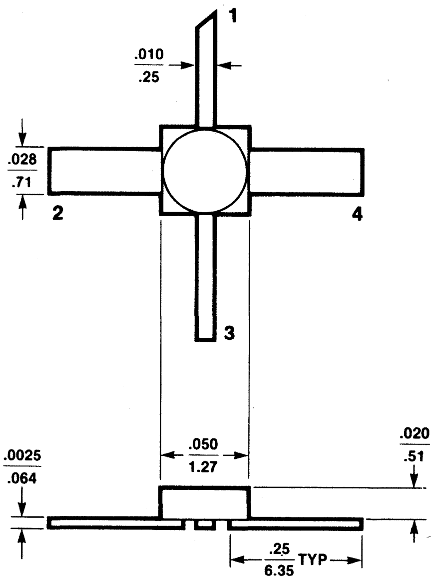
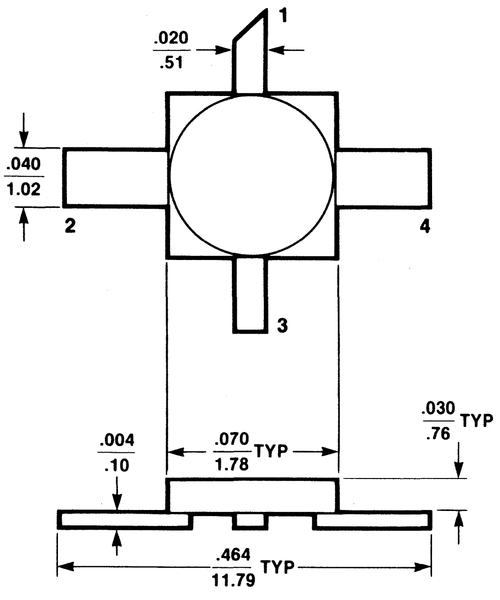
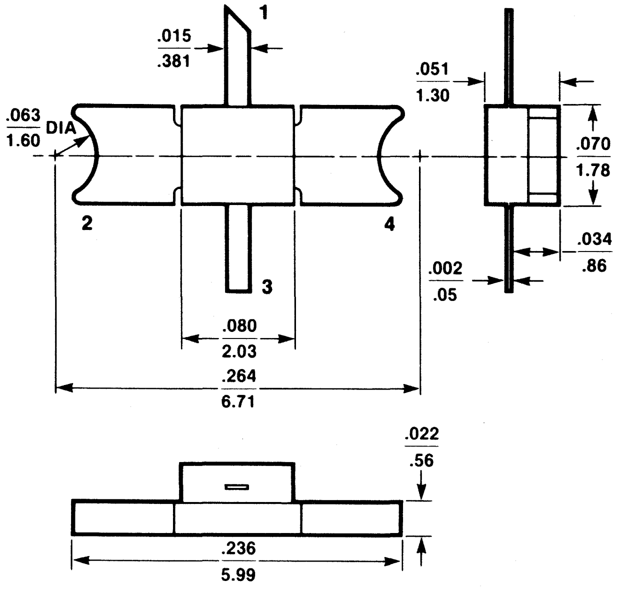


70 MIL STRIPLINE (A, B, C, D)



70 MIL FLANGE (D)

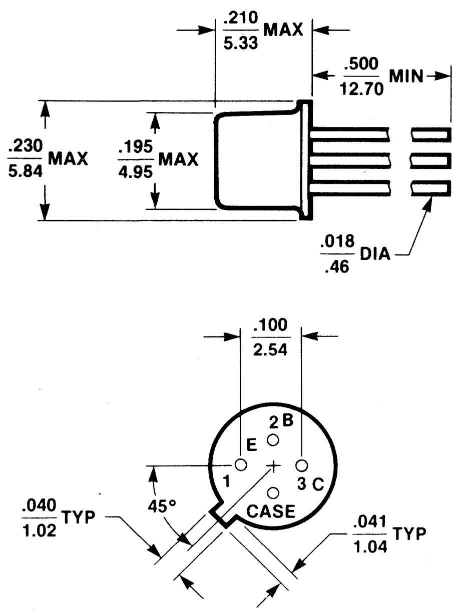


LEAD	1	2	3	4
SILICON BIPOLAR TRANSISTORS	BASE	EMITTER	COLLECTOR	EMITTER
MODAMP™ SINGLE GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT	BIAS
MODAMP™ DUAL GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT AND BIAS	GROUND
DISCRETE AND MATCHED GaAs FETs	GATE	SOURCE	DRAIN	SOURCE

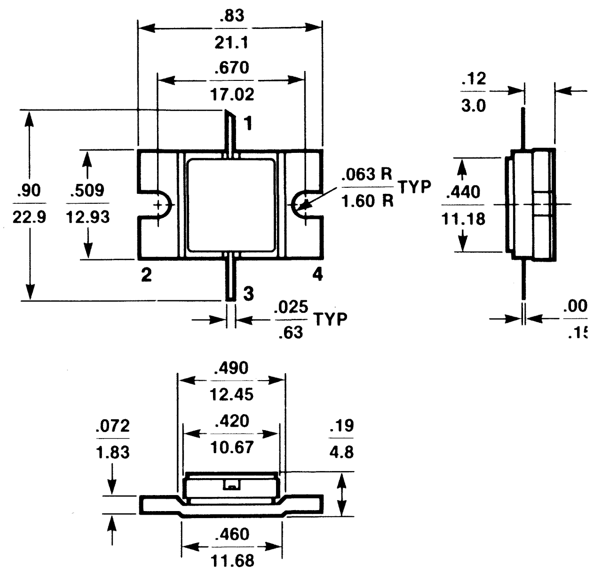
NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

TO-72

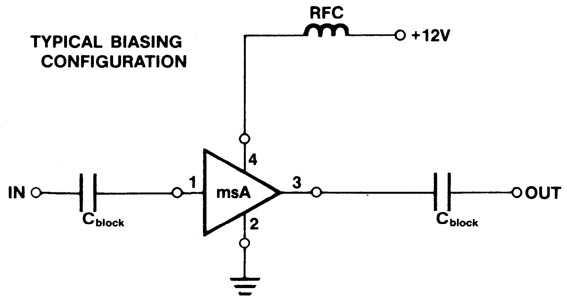


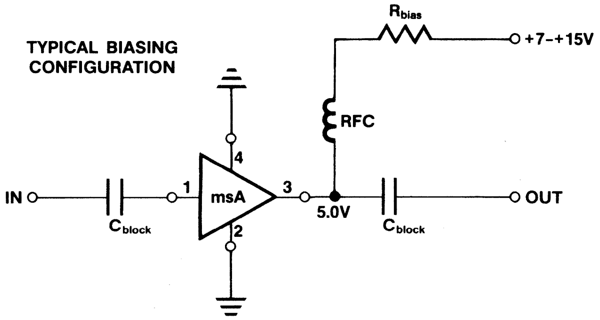
IMFET "98" (D)



SCHEMATIC DRAWING, MSA SERIES MMIC's

Model No. -11,-12 -21,-2



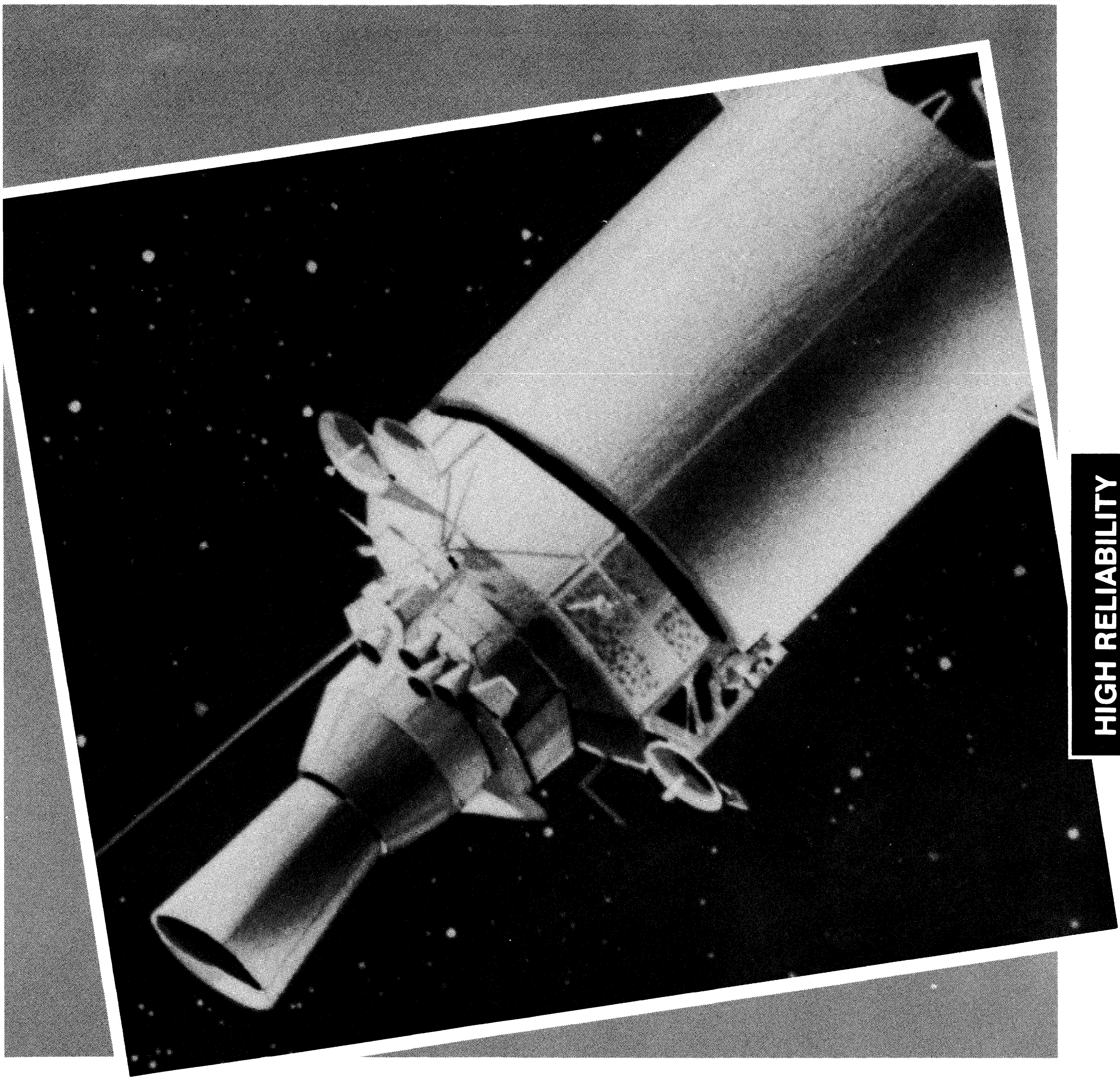


	LEAD	1	2	3	4
A	SILICON BIPOLAR TRANSISTORS	BASE	EMITTER	COLLECTOR	EMITTER
B	MODAMP™ SINGLE GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT	BIAS
C	MODAMP™ DUAL GROUND MMIC's	RF INPUT	GROUND	RF OUTPUT AND BIAS	GROUND
D	DISCRETE AND MATCHED GaAs FETs	GATE	SOURCE	DRAIN	SOURCE

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. DIMENSIONS ARE IN $\frac{\text{IN}}{\text{MM}}$
2. TOLERANCES: $\frac{\text{XXX}}{\text{XX}} \pm \frac{.010}{.25}$

High Reliability Screening



Avantek
High Reliability
Microwave Semiconductor Components

This section explains Avantek's stringent quality control procedures for semiconductor components and suggests mutually acceptable methods of screening to ensure reliability in all customer applications.

Avantek is dedicated to the maintenance of quality in semiconductor products and has established a multi-faceted organization to ensure quality.

Within Avantek, there is a quality assurance group in each operating division reporting directly to the vice-president of the division. Among its tasks, the Semiconductor Division Quality Assurance group is responsible for monitoring the adherence to wafer processing standards, to all types of transistor testing specifications, to all special customer-specified screening and it monitors incoming parts, supplies and materials for adherence to Avante standards and to assure complete traceability and configuration control. A chart of the Semiconductor Divisio and its related quality control/quality assurance organizatio is shown in figure 1.

Within the Semiconductor Division, high reliability screening programs or any programs requiring special testing o handling of components are managed by a designate program management staff to provide project continuit focus and ensure timely completion of the customer orde These special programs often extend over a long perio and require the dedicated attention of specific individual for the best possible coordination of the several functiona groups involved in the program. Avantek has a great dea

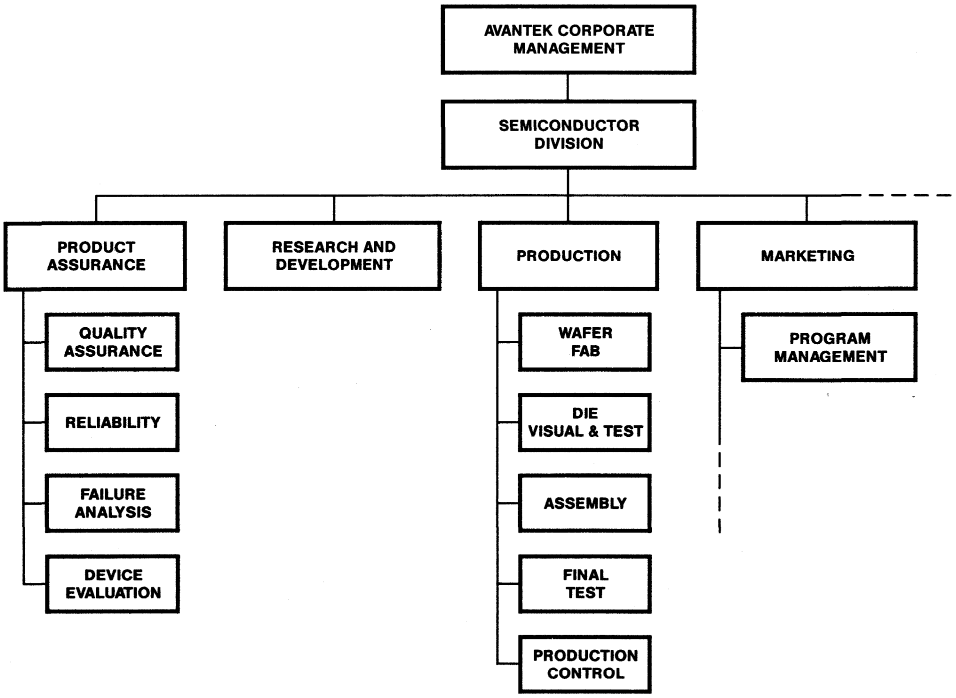


FIGURE 1
QUALITY ASSURANCE, PRODUCT RELIABILITY AND PRODUCTION: SEMICONDUCTOR PRODUCTS

of experience with this type of program, including multi-year projects, space qualification and special customer equirements which are often quite different from military standards testing.

Finally, in order to assure the overall integrity and reliability of Avantek microwave components, and in an effort to continually improve the life-expectancy of the parts, the Semiconductor Division also maintains a Reliability Physics Group. This group is charged with (1) monitoring the eliability of all manufactured semiconductor products and ecommending process changes to improve the reliability of current products, (2) thoroughly evaluating proposed process modifications or process improvements and new ransistor designs to assure long term device reliability and 3) designing special screens for customer requirements.

Quality Standards

Avantek currently offers two levels of reliability screenings: AK-S" and "AK-TXV" for discrete devices and "AK-S" and AK-B" for integrated circuits.

AK-S" Series transistors and integrated circuits are in-ended for space environments or for other applications calling for proven very high reliability, and the most thorough screening. The supporting data generated during the "AK-S" screening provides the most accurate possible indication of device mean time before failure. "AK-TXV" Series transistors and "AK-B" integrated circuits are intended to meet MIL-S-19500, MIL-STD-750, MIL-STD-883 and MIL-M-38510. Prior to the assembly and testing of packaged transistors or to the screening of unpackaged chip transistors, all transistor wafers are processed on the same, highly-controlled production line (the process flow and control steps are shown in figure 2). Thus, reliability is an inherent part of all Avantek transistors. The higher-reliability grades are screened and tested to a higher degree to satisfy customer requirements and to firmly establish and document the transistors' reliability on an individual program basis.

Avantek's suggested Quality Assurance Testing methods and sequences for microwave silicon bipolar transistors and for gallium-arsenide field effect transistors are outlined in the following tables and flow charts. These are not the only tests that can be performed, nor must each test be performed in the outlined sequence if the customer specifies an alternate testing and qualification program. However, the described sequences are those that permit the most expedient process flow.

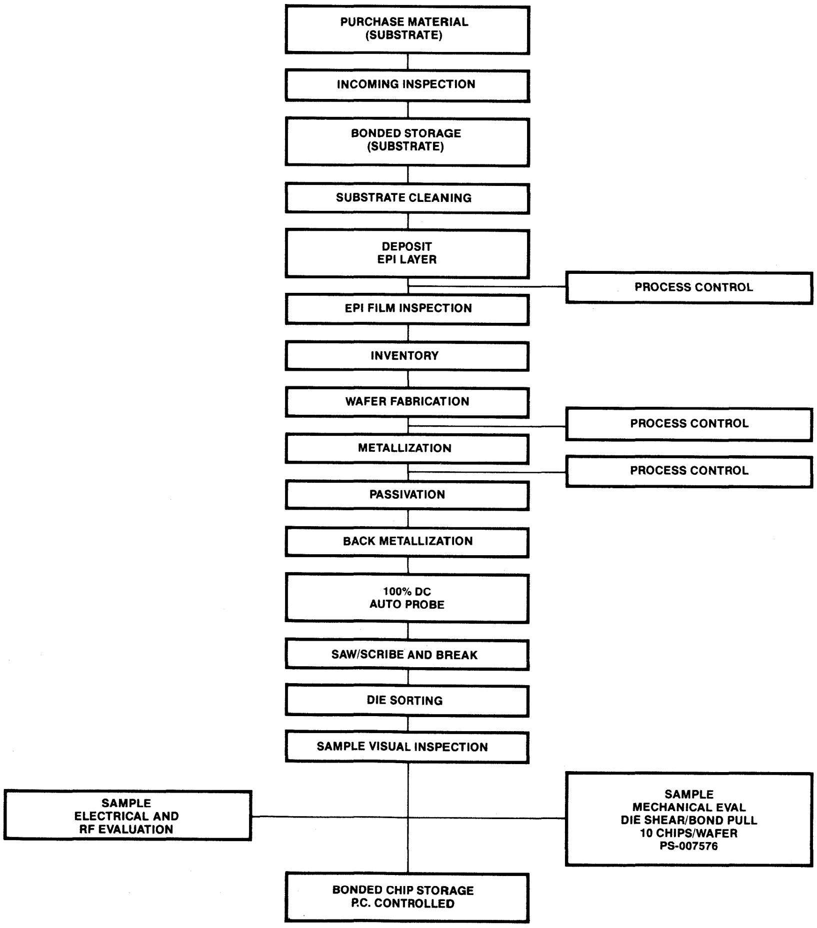


FIGURE 2
TRANSISTOR WAFER COMMON PROCESS FLOW

TABLE 1
GROUP A TESTS—SILICON BIPOLAR TRANSISTORS

	TEST	SYMBOL	MIL-STD-750 METHOD
1.	Visual and Mechanical Exam[1]	—	(AK internal specs.)
2.	Leakage Current/Breakdown Voltage[1]	BV_{CBO}, BV_{EBO}, BV_{CEO}, I_{CBO}, I_{EBO}	3001D, 3026D 3011D, 3036
3.	DC Dynamic Characteristics[1]	h_{FE}, etc.	3076
4.	RF Dynamic Characteristics[1]	NF, G_{NF}, P_{OUT}, G_P, $\lvert S_{21}\rvert^2$	(AK internal specs.)
5.	RF Dynamic Characteristics[2]	f_T, C_{CB}	3261, 3236
6.	Temperature Characteristics[2]	I_{CBO}, BV_{CBO}, h_{FE}	3936

[1] Performed on a 100% basis on all parts per detailed part data sheet.
[2] Performed per customer request.

TABLE 2
AVANTEK MILITARY EQUIVALENT[1]
PRECONDITIONING AND SCREENING—SILICON BIPOLAR TRANSISTORS

	TEST	MIL-STD-750 METHOD	CONDITION	AK-S	AK-TXV
1.	Precap Visual Inspection	2072	AK specification AWS-014355-800	100%	100%
2.	Electrical tests (Avantek Option)		As defined in applicable data sheet	100%	100%
3.	Stabilization Bake	1032	24 hrs., 150° C	100%	100%
4.	Temperature Cycling	1051	Cond. C. 20 cycles min. -65° C to 200° C	100%	100%
5.	Constant Acceleration	2006	20K G's Y1 plane	100%	100%
6.	Particle Impact noise detection	2052	Cond. A or B	100%	—
7.	Interim Electrical	—	h_{FE}, I_{CBO}	100%	100%
8.	High Temperature Reverse Bias	1039	Cond. A, 48 h. $T_A=150°C$ $V_{CB}=80\%\ BV_{CBO}$	100%	100%
9.	Interim Electrical Tests and Delta[2]		$\Delta h_{FE}=\pm 25\%$ $\Delta I_{CBO}=100\%$	100%	100%
10.	Power Burn-In[3]	1039	Cond. B P_{DC}=Max. rated T_J=As appropriate	240 h.	168 h.
11.	Final Electrical Tests (Post Burn-in and Group A)		Per applicable data sheet		
	(a) Interim electrical and Delta tests[2]		$\Delta h_{FE}=\pm 25\%$ $\Delta I_{CBO}=\pm 100\%$	100%	100%
	(b) Per device data sheet		DC and RF	100%	100%
	(c) $T_{HIGH}=+150°C$		I_{CBO}	LTPD=3	LTPD=5
	$T_{LOW}=-55°C$		h_{FE}	LTPD=3	LTPD=5
12.	Lot Acceptance (PDA) 10%		Interim electrical and delta	Applies	Applies
13.	Hermetic Seal Tests[4] —Fine	1071	Cond. H or G	100%	100%
	—Gross	1071	Cond. A, C, E or F	100%	100%
14.	Radiography	2076		100%	—
15.	External visual examination	2071		100%	100%

NOTES:
[1] Per Table II of MIL-S-19500 JAN-S and JAN-TXV screening requirements. Additional thermal and mechanical environments may be added as a customer option.
[2] Limit depends upon value specified in the applicable data sheet.
[3] The ambient temperature chosen is dependent upon P_{DC} and the associated thermal resistance.
[4] May be performed after mechanical environments.

TABLE 3
AVANTEK MILITARY EQUIVALENT[1]
PRECONDITIONING AND SCREENING—SILICON MONOLITHIC INTEGRATED CIRCUITS
MIL-STD-883

	TEST	METHOD	CONDITION	AK-S	AK-B
1.	Precap Visual Inspection	2010	AK specification AWS-014355-800	100%	100%
2.	Electrical tests (Avantek Option)		As defined in applicable data sheet	100%	100%
3.	Stabilization Bake	1008	24 hrs., 150°C	100%	100%
4.	Temperature Cycling	1010	Cond. C. 20 cycles min. -65°C to 200°C	100%	100%
5.	Constant Acceleration	2001	20K G's Y1 plane	100%	100%
6.	Particle Impact noise detection	2020	Cond. A	100%	—
7.	Interim Electrical	—	$\|S_{21}\|^2$, f_{1dB}	100%	100%
8.	Power Burn-In[3]	1015	$T_J = +150°C$	240 h.	160 h.
9.	Final Electrical Tests (Post Burn-in and Group A)		Per applicable data sheet [2]		
			$\Delta\|S_{21}\|^2 = \pm 10\%$ $\Delta f_{1dB} = \pm 10\%$	100%	100%
10.	Lot Acceptance (PDA) 10%		Interim electrical and delta	Applies	Applies
11.	Hermetic Seal Tests[4] —Fine	1014	Cond. A or B	100%	100%
	—Gross	1014	Cond. C	100%	100%
12.	Radiography	2012	Two views	100%	—
13.	External visual examination	2009		100%	100%

NOTES:

[1] Per MIL-M-38510 (Class S and Class B of MIL-STD-883 screening requirements to the extent specified). Additional thermal and mechanical environments may be added as a customer option

[2] Limit depends upon value specified in the applicable data sheet.

[3] The ambient temperature chosen is dependent upon P_{DC} and the associated thermal resistance.

[4] May be performed after mechanical environments.

TABLE 4
GROUP B TESTS[1]—SILICON BIPOLAR TRANSISTORS

TEST	MIL-STD-750 METHOD	CONDITION
Subgroup 1		
Physical Dimensions	2066	Per Part Data Sheet
Subgroup 2		
Solderability	2026	(Without Aging)
Temperature Cycling	1051	Condition C
Moisture Resistance	1021	(Omit Initial Conditioning)
End Point Tests:		
h_{FE}, I_{CBO}	3036, 3076	To Data Sheet Spec.
Subgroup 3		
Shock	2016	Non-operating 1500G, 5 Blows of 0.5m sec each in X, Y and Z orientations
Vibration, Fatigue	2046	Non-operating
Vibration, Variable Freq.	2056	Non-operating
Constant Acceleration	2006	20K G, Y, axis
End Point Tests:		
Same as Subgroup 2		
Subgroup 4		
Terminal Strength	2036	Condition E
End Point Tests:		
Hermetic Seal	1071	Condition A or B, Condition C
Subgroup 5		
Steady State Operating Life	1026	t=1000 hrs.
End Point Tests:		
Same as Subgroup 2		

[1] Small Lot Procurement.

TABLE 5
GROUP A TESTS—GALLIUM ARSENIDE FETs

	TEST	SYMBOL	MIL-STD-750 METHOD
1.	Visual and Mechanical Exam[1] (Sample)	—	(AK internal specs)
2.	Leakage Current/Breakdown Voltage[1]	BV_{gs}, BV_{gd}, I_{GSS}, I_{DSS}, V_P	3411, 3413, 3403 and (AK internal specs)
3.	D.C. Dynamic Characteristics[1]	g_m	3455
4.	Thermal Resistance (power FETs only)	θ_{CH-C}	(AK internal specs)
5.	RF Dynamic Characteristics[1] (per detailed data sheet)	NF, G_{NF}, P_{OUT}, G_P, $\|S_{21}\|^2$	(AK internal specs)
6.	Temperature Characteristics[2]	I_{DSS}, V_P, g_M	3936

[1] Performed on a 100% basis on all parts per detailed part data sheet.
[2] Performed per customer request.

TABLE 6
AVANTEK MILITARY EQUIVALENT[1]
PRECONDITIONING AND SCREENING—DISCRETE GaAs FET PRODUCTS

	TEST	MIL-STD-750 METHOD	CONDITION	AK-S	AK-TXV
1.	Precap Visual Inspection	2072	AK specification AWS-014355-800	100%	100%
2.	Electrical tests (Avantek Option)		As defined in applicable data sheet	100%	100%
3.	Stabilization Bake	1032	24 hrs., 150° C	100%	100%
4.	Temperature Cycling	1051	Cond. C. 20 cycles min. -65° C to 200° C	100%	100%
5.	Constant Acceleration	2006	20K G's Y1 plane	100%	100%
6.	Particle Impact noise detection	2052	Cond. A or B	100%	—
7.	Interim Electrical	—	I_{DSS}, g_M, V_P	100%	100%
8.	High Temperature Reverse Bias	1039	Cond. A, 48 h. $T_A = 150°$ C $V_{GS} = 80\%$. BV_{GS}	100%	100%
9.	Interim Electrical Tests and Delta[2]		$\Delta I_{DSS} = \pm 15\%$ $\Delta g_M = \pm 15\%$ $\Delta V_P = \pm 10\%$	100%	100%
10.	Power Burn-In[3]	1039	Cond. B P_{DC} = Max. rated T_{CH} = As appropriate	240 h.	168 h.
11.	Final Electrical Tests (Post Burn-in and Group A)		Per applicable data sheet		
	(a) Interim electrical and Delta tests[2]		$\Delta I_{DSS} = \pm 15\%$ $\Delta g_M = \pm 15\%$ $\Delta V_P = \pm 10\%$	100%	100%
	(b) Per device data sheet		DC and RF	100%	100%
	(c) $T_{HIGH} = +150°$ C		I_{GSS}	LTPD=3	LTPD=5
	$T_{LOW} = -55°$ C		I_{DSS}	LTPD=3	LTPD=5
12.	Lot Acceptance (PDA) 10%		Interim electrical and delta	Applies	Applies
13.	Hermetic Seal Tests[4] —Fine	1071	Cond. H or G	100%	100%
	—Gross	1071	Cond. A, C, E or F	100%	100%
14.	Radiography	2076		100%	—
15.	External visual examination	2071		100%	100%

NOTES:
[1] Per Table II of MIL-S-19500 JAN-S and JAN-TXV screening requirements. Additional thermal and mechanical environments may be added as a customer option.
[2] Limit depends upon value specified in the applicable data sheet.
[3] The ambient temperature chosen is dependent upon P_{DC} and the associated thermal resistance.
[4] May be performed after mechanical environments.

TABLE 7
AVANTEK MILITARY EQUIVALENT[1]
PRECONDITIONING AND SCREENING—INTERNALLY MATCHED POWER GaAs FET PRODUCTS
MIL-STD-883

	TEST	METHOD	CONDITION	AK-S	AK-B
1.	Precap Visual Inspection	2010	AK specification AWS-014355-800	100%	100%
2.	Electrical tests (Avantek Option)		As defined in applicable data sheet	100%	100%
3.	Stabilization Bake	1008	24 hrs., 150° C	100%	100%
4.	Temperature Cycling	1010	Cond. C. 20 cycles min -65° C to 150° C	100%	100%
5.	Constant Acceleration	2001	10K G's Y1 plane	100%	100%
6.	Particle Impact noise detection	2020	Cond. A	100%	—
7.	Interim Electrical[2]	—	I_{DSS}, g_M, V_P	100%	—
8.	High Temperature Reverse Bias	1015	Cond. A, 72 h. $T_A = 150°C$ $V_{GS} = 80\%$. BV_{GS}	100%	—
9.	Interim Electrical Tests and Delta[3]		$\Delta I_{DSS} = \pm 15\%$ $\Delta g_M = \pm 15\%$ $\Delta V_P = \pm 10\%$ $\Delta I_{GSS} = +5 \mu A$[6]	100%	100%
10.	Power Burn-In[4]	1015	P_{DC} = Max. rated T_{CH} = As appropriate[4]	240 h.	160 h.
11.	Final Electrical Tests (Post Burn-in and Group A)		Per applicable data sheet		
	(a) Interim electrical and Delta tests[3]		$\Delta I_{DSS} = \pm 15\%$ $\Delta g_M = \pm 15\%$ $\Delta V_P \pm 10\%$ $\Delta I_{GSS} = +5 \mu A$[6]	100%	100%
	(b) Per device data sheet		DC and RF	100%	100%
12.	Lot Acceptance (PDA) 10%		Interim electrical and delta	Applies	Applies
13.	Hermetic Seal Tests —Fine	1014	Cond. A or B	100%	100%
	—Gross	1014	Cond. C	100%	100%
14.	Radiography	2012	Two views	100%	—
15.	External visual examination	2009		100%	100%

NOTES:

[1] Per Method 5004 of MIL-M-38510 (Class S and Class B screening requirements to the extent specified). Additional thermal and mechanical environments may be added as a customer option.

[2] Read and record data only (AK-S only).

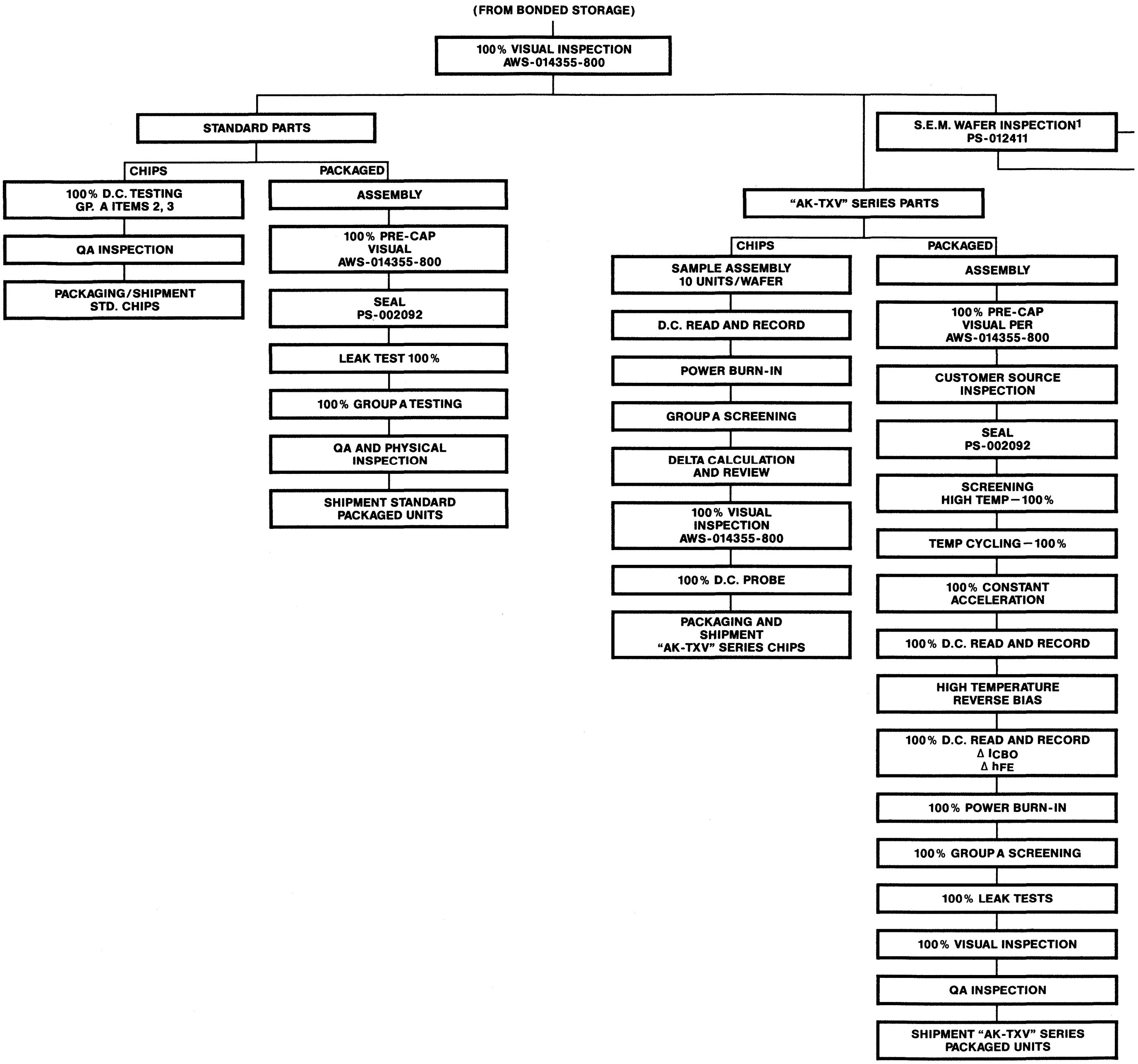
[3] Limit depends upon value specified in the applicable data sheet.

[4] The ambient temperature chosen is dependent upon P_{DC} and the associated thermal resistance.

[5] May be performed after mechanical environments.

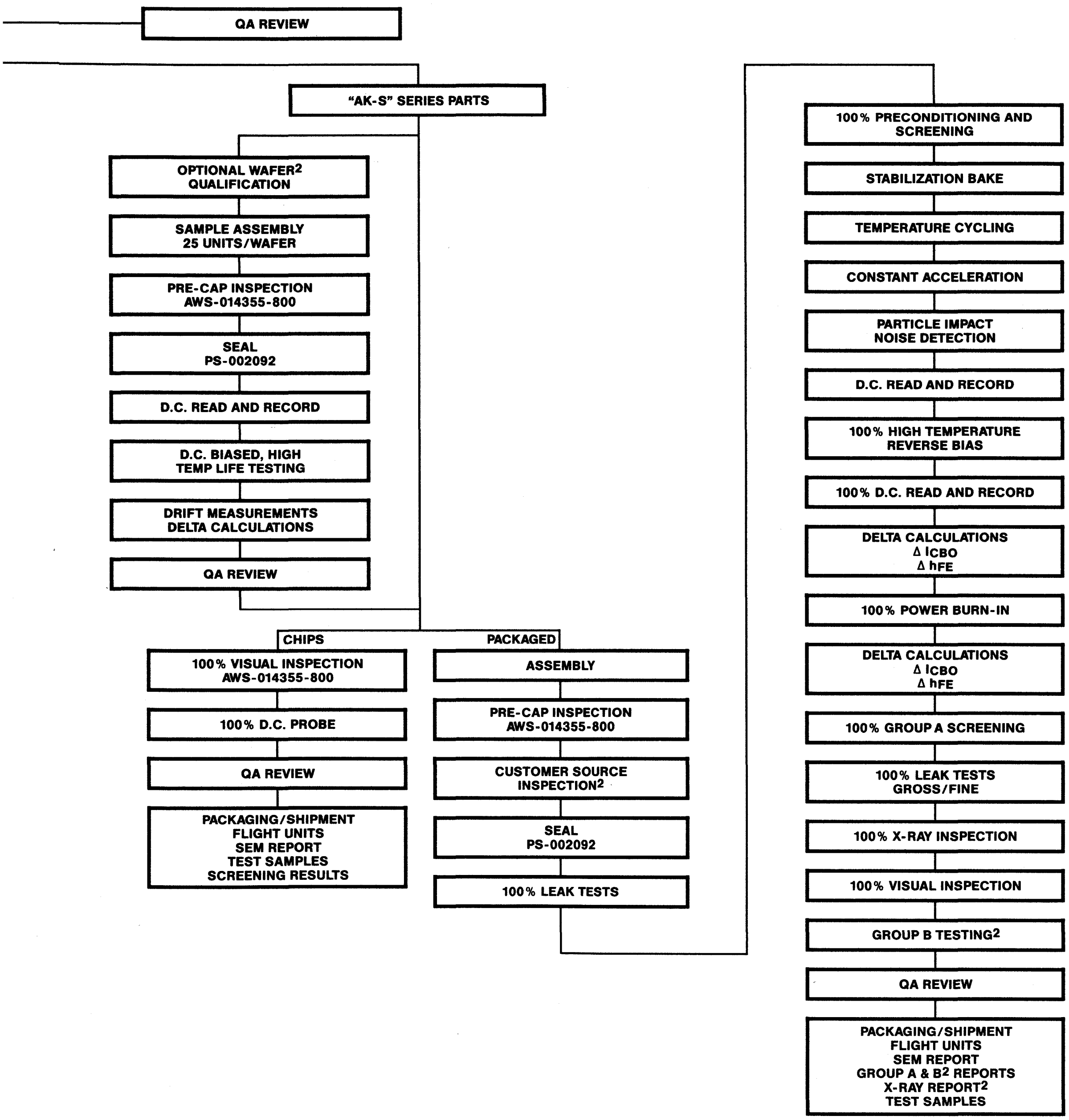
[6] Or +100%, whichever is greater.

FLOW DIAGRAM 1
MICROWAVE SILICON BIPOLAR TRANSISTORS QUALITY ASSURANCE PROGRAM



NOTES:

1. OPTION PER CUSTOMER REQUEST ON "AK-TXV" PARTS. 100% ON "AK-S" PARTS.
2. OPTION PER CUSTOMER REQUEST.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"AK-S" SERIES PARTS
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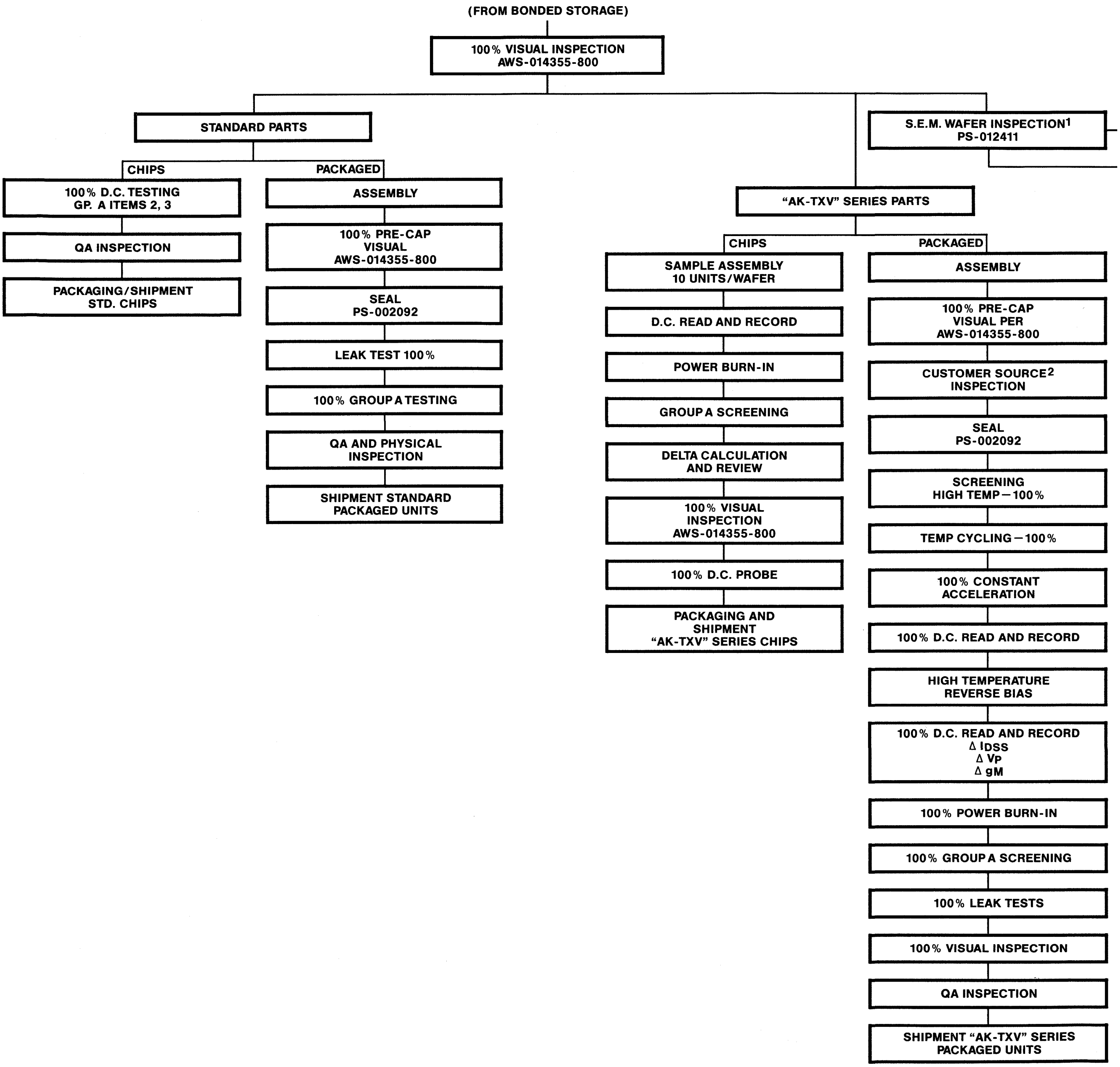
SAMPLE ASSEMBLY 25 UNITS/WAFER
PRE-CAP INSPECTION AWS-014355-800
SEAL PS-002092
D.C. READ AND RECORD
D.C. BIASED, HIGH TEMP LIFE TESTING
DRIFT MEASUREMENTS DELTA CALCULATIONS
QA REVIEW
CHIPS
100% VISUAL INSPECTION AWS-014355-800
100% D.C. PROBE
QA REVIEW
PACKAGING/SHIPMENT FLIGHT UNITS SEM REPORT TEST SAMPLES SCREENING RESULTS
PACKAGED
ASSEMBLY
PRE-CAP INSPECTION AWS-014355-800
CUSTOMER SOURCE INSPECTION2
SEAL PS-002092
100% LEAK TESTS
100% PRECONDITIONING AND SCREENING
STABILIZATION BAKE
TEMPERATURE CYCLING
CONSTANT ACCELERATION
PARTICLE IMPACT NOISE DETECTION
D.C. READ AND RECORD
100% HIGH TEMPERATURE REVERSE BIAS
100% D.C. READ AND RECORD
DELTA CALCULATIONS Δ I_{CBO} Δ h_{FE}
100% POWER BURN-IN
DELTA CALCULATIONS Δ I_{CBO} Δ h_{FE}
100% GROUP A SCREENING
100% LEAK TESTS GROSS/FINE
100% X-RAY INSPECTION
100% VISUAL INSPECTION
GROUP B TESTING2
QA REVIEW
PACKAGING/SHIPMENT FLIGHT UNITS SEM REPORT GROUP A & B2 REPORTS X-RAY REPORT2 TEST SAMPLES

FLOW DIAGRAM 2
MICROWAVE GALLIUM ARSENIDE FETs QUALITY ASSURANCE PROGRAM



NOTES:

1. OPTION PER CUSTOMER REQUEST ON "AK-TXV" PARTS. 100% ON "AK-S" PARTS.
2. OPTION PER CUSTOMER REQUEST.

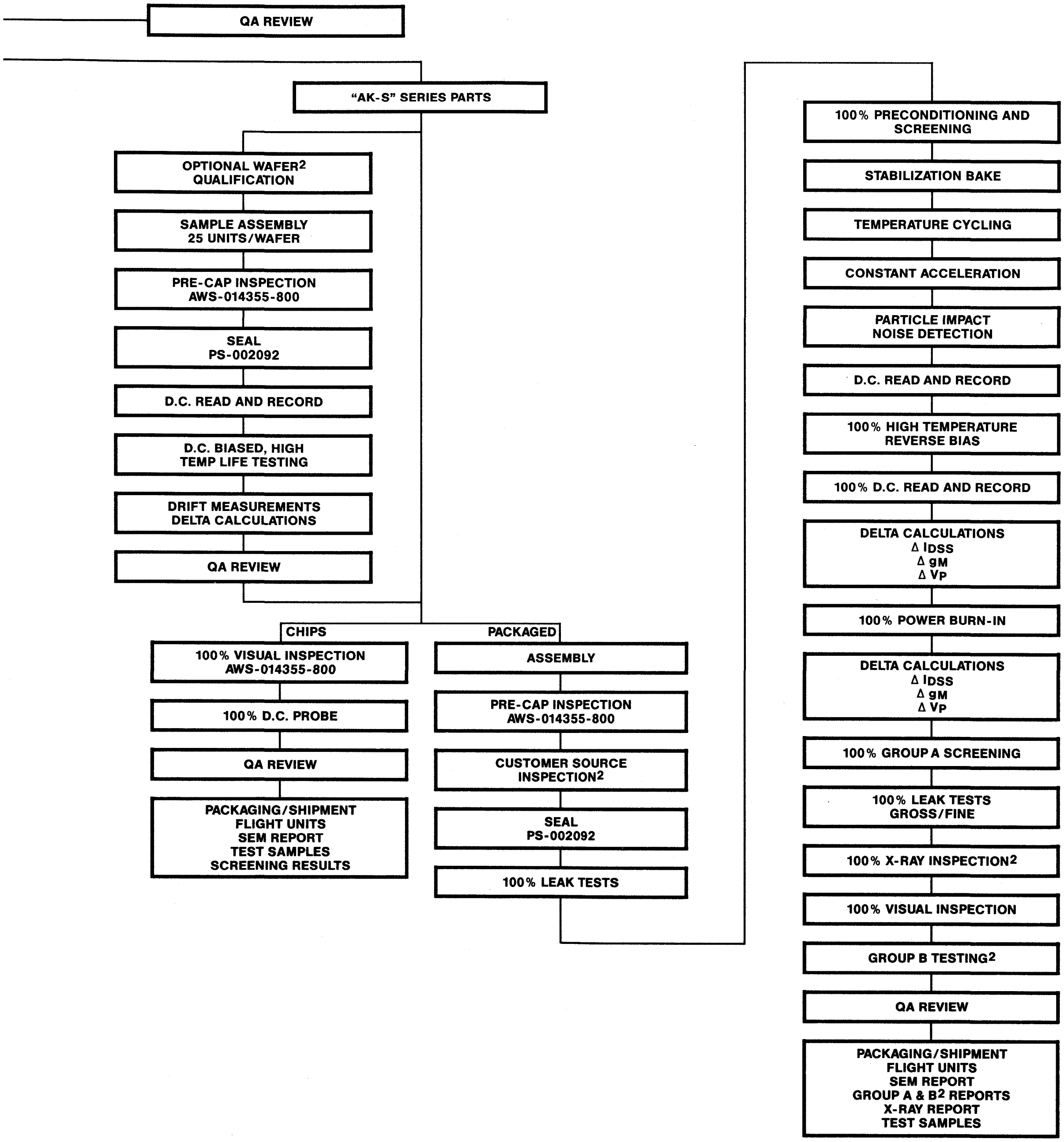
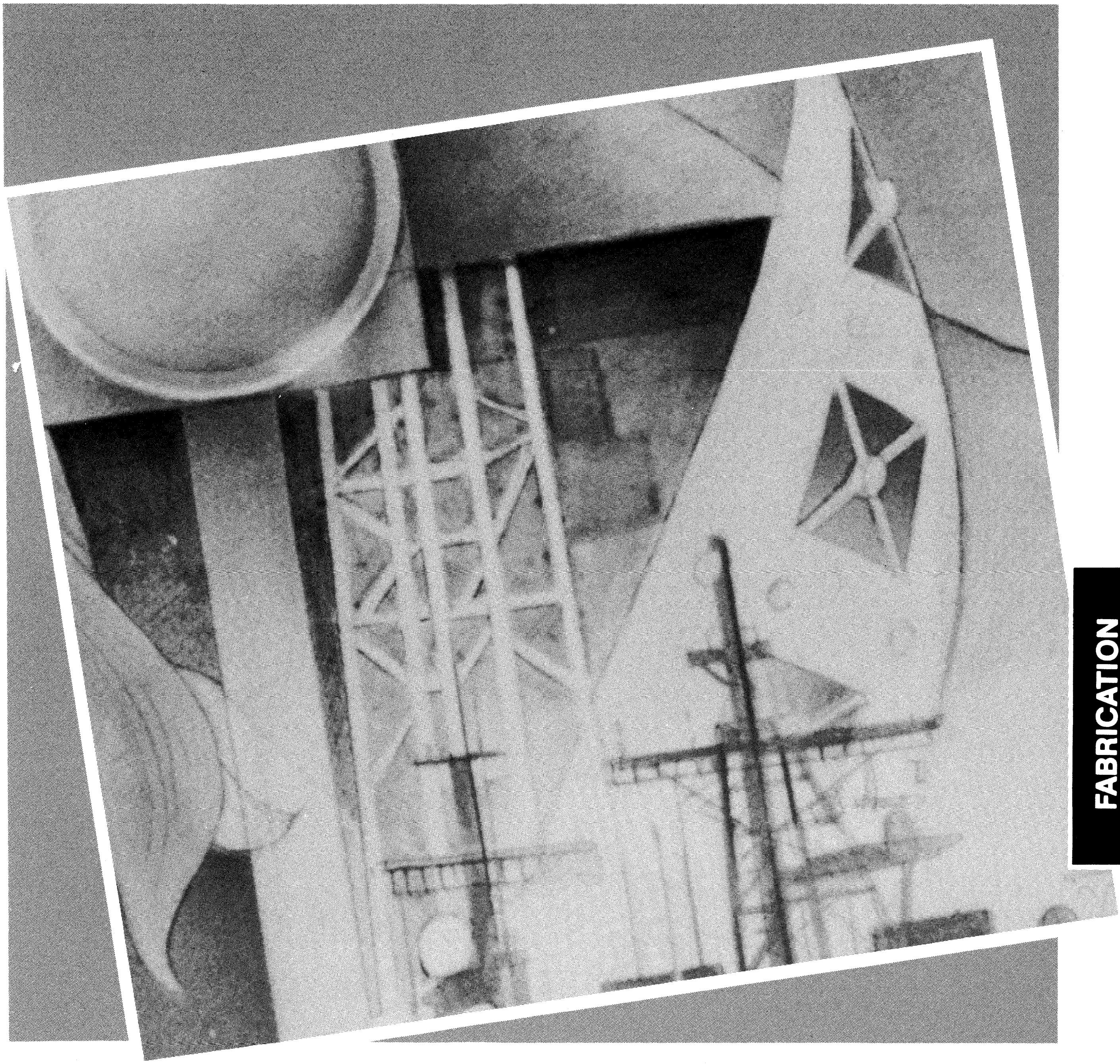

QA REVIEW
"AK-S" SERIES PARTS
OPTIONAL WAFER2 QUALIFICATION
SAMPLE ASSEMBLY 25 UNITS/WAFER
PRE-CAP INSPECTION AWS-014355-800
SEAL PS-002092
D.C. READ AND RECORD
D.C. BIASED, HIGH TEMP LIFE TESTING
DRIFT MEASUREMENTS DELTA CALCULATIONS
QA REVIEW
CHIPS
100% VISUAL INSPECTION AWS-014355-800
100% D.C. PROBE
QA REVIEW
PACKAGING/SHIPMENT FLIGHT UNITS SEM REPORT TEST SAMPLES SCREENING RESULTS
PACKAGED
ASSEMBLY
PRE-CAP INSPECTION AWS-014355-800
CUSTOMER SOURCE INSPECTION2
SEAL PS-002092
100% LEAK TESTS
100% PRECONDITIONING AND SCREENING
STABILIZATION BAKE
TEMPERATURE CYCLING
CONSTANT ACCELERATION
PARTICLE IMPACT NOISE DETECTION
D.C. READ AND RECORD
100% HIGH TEMPERATURE REVERSE BIAS
100% D.C. READ AND RECORD
DELTA CALCULATIONS ΔI_{DSS} Δg_M ΔV_P
100% POWER BURN-IN
DELTA CALCULATIONS ΔI_{DSS} Δg_M ΔV_P
100% GROUP A SCREENING
100% LEAK TESTS GROSS/FINE
100% X-RAY INSPECTION2
100% VISUAL INSPECTION
GROUP B TESTING2
QA REVIEW
PACKAGING/SHIPMENT FLIGHT UNITS SEM REPORT GROUP A & B2 REPORTS X-RAY REPORT TEST SAMPLES

TABLE 8
GROUP B TESTS[1] FOR GALLIUM-ARSENIDE FETs

TEST	MIL-STD-750 METHOD	CONDITION
Subgroup 1		
Physical Dimensions	2066	Per Part Data Sheet
Subgroup 2		
Solderability	2026	Omit Aging
Temp. Cycling	1051	Condition C
Moisture Resistance	1021	Omit Initial Conditions
End Point Tests: g_m, I_{DSS}, V_P	3411, 3413, 3403	To data sheet specs
Subgroup 3		
Shock	2016	Non-operating 1500G, 5 blows, X, Y and Z
Vibration, Fatigue	2046	Non-operating
Vibration Variable Freq.	2056	Non-operating
Constant Acceleration	2006	20K G, Y1 only
End Point Tests: (Same as Subgroup 2 above)		
Subgroup 4		
Terminal Strength	2036	Condition E
End Point Tests: Hermetic Seal	1071	Cond. H, Cond. C, Step 2
Subgroup 5		
Steady State Operating Life	1026	$t = 1000$ hrs. @ $T_{CH} = 125°C$
End Point Tests: (Same as Subgroup 2 above)		

[1] Small Lot Procurement.

Fabrication Service



GaAs Fabrication Service

Avantek is a leading manufacturer of RF and microwave components for military and telecommunications markets. To support this leadership Avantek is one of the world's largest producers of both low noise and medium power microwave Gallium Arsenide transistors. Avantek is now making this technology available to external customers by offering a GaAs Fabrication Service. This service is based on the high performance depletion mode GaAs MESFET process which is used to produce the Avantek range of microwave transistors.

Process Description

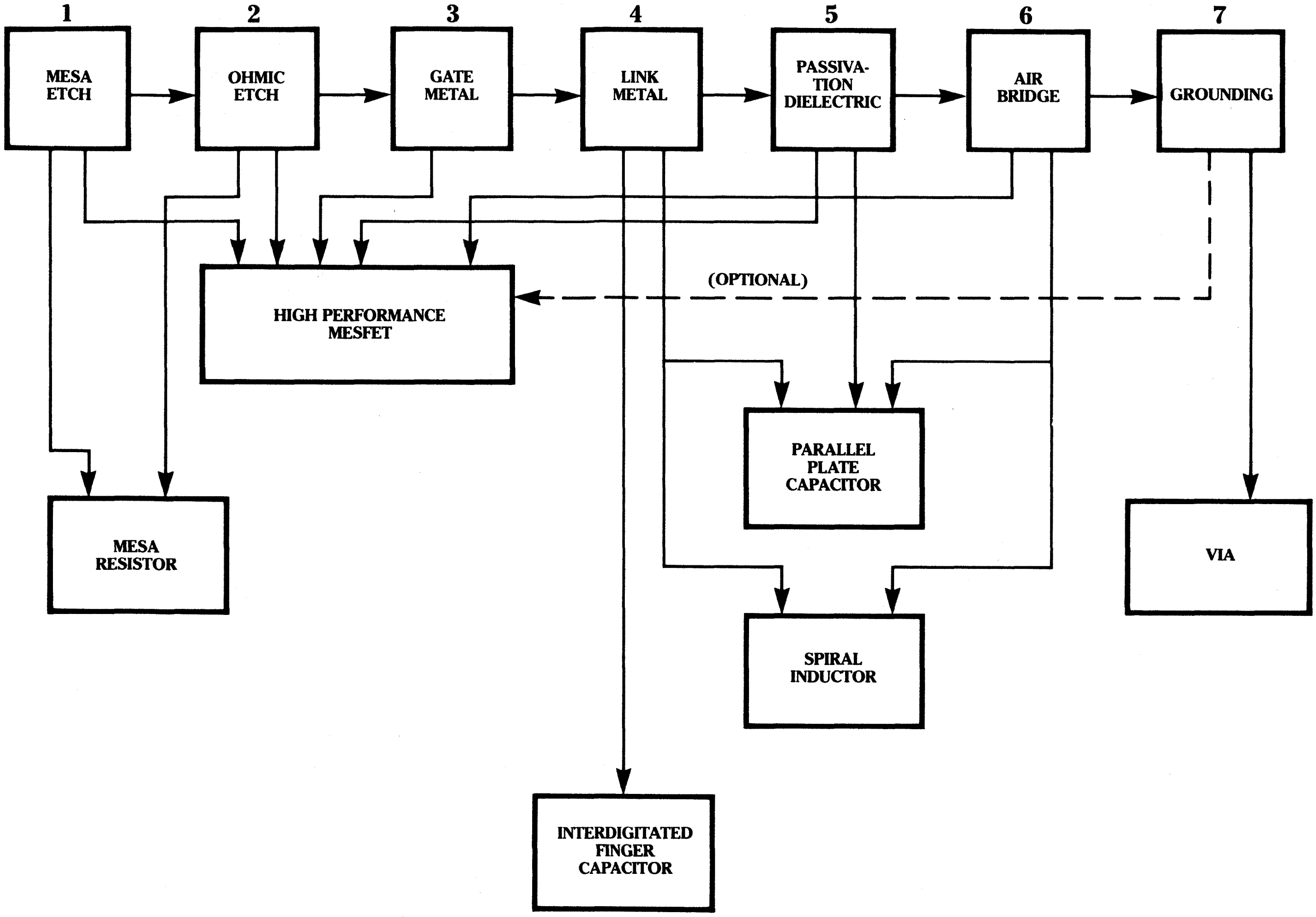
The GaAs MMIC process is based on 0.5 micron depletion mode technology. This process is capable of producing either high speed digital or microwave analog circuits and is well suited to produce IC's to 26GHz.

Process Features:

- Low Noise and Power FETs
  Typical Parameters
  2.5dB N.F. @ 18GHz
  10dB MAG @ 18GHz
  24dBm/mm gate width P_{1dB} @ 18GHz
- GaAs Resistors
  -Design Parameters
  500Ω/square
- Si Nitride Capacitors
  Design Parameters
  390pf/square
- Spiral Inductors
  up to 12GHz
- Interdigitated Capacitors
- Schottky diodes
- Air bridge crossovers
- On Chip Grounding

Services:

- Check plot review
- Wafer sorting
- Fab service documentation
- Test cell testing



Block Diagram Of The Avantek Monolithic GaAs Ic Process Flow

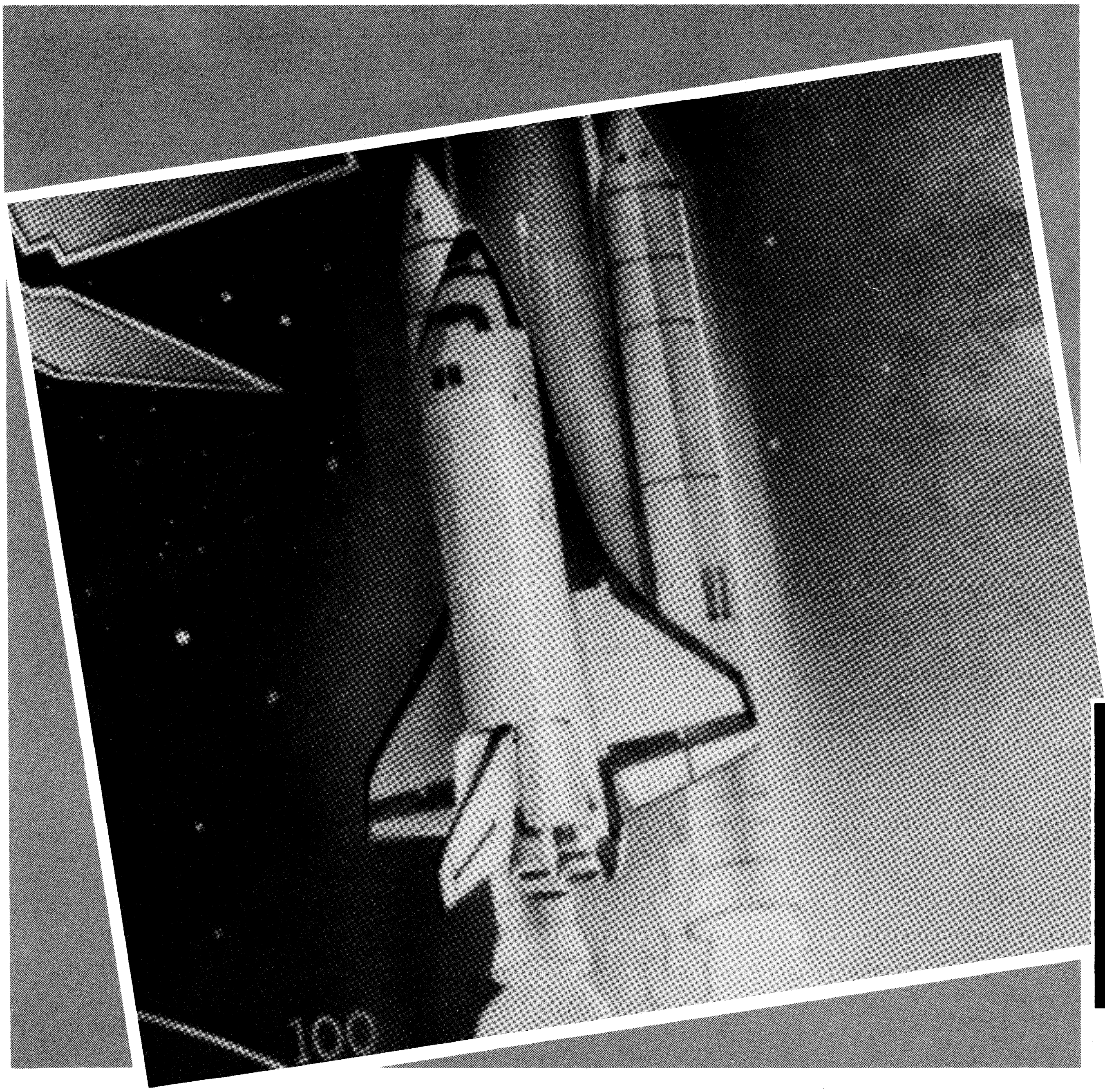
Ordering Information

The general procedure for Avantek's interaction with a customer will follow the steps outlined below:

1. Discussion with customer on general requirements and compatibility with Avantek's process. This will involve interaction with Avantek R & D personnel and the provision of 0.5 μm gate MESFET model.
2. Customer writes statement of work to detail specific process steps needed, in process measurements and final wafer acceptance critria, etc.
3. An Avantek part number is assigned and quotation made covering N.R.E. charges and wafer pricing. Non-disclosure statements signed if applicable.
4. Customer places order.
5. Avantek furnishes process design rules to customer.
6. Avantek R & D group reviews "check plots" and mask plates as appropriate to ensure compatibility with Avantek processes and procedures.
7. Working mask set shipped to Avantek.
8. Wafers processed and shipped to customer together with test data. Time typically 8-12 weeks after receipt of working mask set.

Customers using our microwave monolithic integrated circuit (MMIC) foundry will benefit from Avantek's sixteen years of experience in fabricating microwave transistors, as well as our advanced facilities for manufacturing both silicon and gallium arsenide MMICs. This service should be particularly attractive to microwave system and OEM manufacturers as it provides a cost effective solution for their unique semiconductor requirements.

Application Notes



APPLICATION NOTES

APPLICATION NOTES

The following application notes are available on request from any Avantek Representative or from Avantek Corporate Advertising Department, 3175 Bowers Ave., Santa Clara, CA 95051. You may phone your request to (408) 970-2583 or use one of the reply cards at the back of this catalog.

Measurement and Modelling of GaAs FET Chips

This note presents a discussion of the RF hardware necessary for the characterization of microwave transistor chips. The approach described utilizes coaxial test fixtures and is suitable for measurements from DC to 40 GHz. Also described are modelling techniques for extrapolation of S-parameters beyond the measurement frequencies.

Transistor and MOS Capacitor Chip Use

This is a comprehensive presentation detailing mechanical handling, die attach procedures, bonding and electrostatic discharge precautions necessary when using transistor and MOS capacitor chips.

High-Frequency Transistor Primer, Part I
Silicon Bipolar Electrical Characteristics

A short glossary and brief explanation of transistor terms commonly used in Avantek transistor data sheets, advertisements and other technical communications.

High-Frequency Transistor Primer, Part II
Noise and S-Parameter Characterization

A short summary of the S-parameter and noise parameters commonly used on Avantek transistor data sheets and their functional relationship to noise figure, gain, stability, impedance matching and other parameters necessary for high frequency circuit design.

High-Frequency Transistor Primer, Part III
Thermal Properties

Intended as an introduction to the thermal characteristics of GaAs FET and silicon bipolar transistors, this note provides a guide to basic thermal calculations necessary for safe temperature operation and long-term reliability.

High Frequency Transistor Primer, Part IV
GaAs FET Characteristics

A brief explanation of the terms commonly used in Avantek GaAs FET data sheets, advertisements and other technical communications. Included is a brief discussion of fabrication techniques and the resulting impact on performance.

Other Avantek Capabilities

Microwave Component Division

Avantek's Microwave Component Division produces the industry's largest and most varied line of solid-state microwave products. These standard products include low-noise and medium power amplifiers; YIG-tuned and varactor-tuned oscillators; tracking YIG filters; double-balanced mixers; analog and digitally controlled microwave switches, limiters and detectors and a wide range of related signal-processing components. Proprietary products include various amplifiers incorporating MODAMP™ silicon MMICs and/or IMFET™ high power internally matched GaAs FETs and various products in the PlanarPak™ package, the industry's first surface mounted microwave component package which can accommodate complex functions such as an AGC amplifier using monolithic gain blocks and integrated subassemblies which combine many functions into one compact package.

Avantek components are selected by commercial and military equipment manufacturers because of their combination of excellent performance, high reliability and extremely compact size. Avantek's microwave components are a vital part of virtually all of today's latest generation airborne, naval and ground-based electronic defense systems. They are also used in microwave test instruments and communications systems produced by many of the largest commercial original equipment manufacturers.

Automated production technology with robotic die placement and computer-controlled equipment such as wire bonders and laser resistor trimmers, drills and welders assure consistent performance of Avantek components.

Microwave Components Division Products

Oscillators

- Economical miniature varactor tuned oscillators in TO-8 packages
- Narrowband low-noise VCOs
- Multi-octave YIG-tuned oscillators and filters
- Mixed frequency dielectrically stabilized oscillators
- Complex assemblies containing multiple oscillators with associated functional and control circuitry
- Digital and analog drivers

Modular Components

- High gain, dual in-line packaged cascadable amplifiers
- Thin-film attenuators
- Thin-film signal limiters
- Thin-film level detectors
- Silicon and GaAs thin-film amplifiers
- Thin-film voltage controlled amplifiers
- Double balanced mixers
- Avanpak™ miniature microwave flatpacks
- Avanpak™ packaged microwave mixers
- Avanpak™ packaged GaAs thin-film amplifiers
- Avanpak™ packaged GaAs thin-film pin-diode switches and limiters
- PlanarPak™ thin-film amplifiers and limiters

Amplifiers

- Low noise wideband amplifiers
- GaAs FET thin-film limiting amplifiers
- Temperature compensated GaAS FET thin-film amplifiers
- Wideband medium power amplifiers
- Solid-state TWT replacement amplifiers
- Communication and radar band amplifiers
  - -low noise
  - -medium power
  - -high power

Telecommunications Division

The Telecommunications Division vertically integrates Avantek microwave transistors, components and multifunction assemblies into proprietary equipment and subsystem product lines for commercial and defense markets. The apex of Avantek's vertical integration is a total telecommunications systems capability in which the Avantek staff designs, develops and installs ready-to-operate fully guaranteed "turnkey" systems.

Avantek pioneered digital microwave radio technology in the United States and over ten years ago developed the first 2 GHz digital microwave radio equipment to be type accepted by the Federal Communications Commission. With over 1600 radios in use by AT&T and independent telephone companies throughout the U.S., and by several foreign governments, Avantek digital radios are well known to the telecommunications industry. Capabilities include advanced 2, 4, 6 and 18 GHz digital radio terminals and repeaters designed for point-to-point transmission of digitally formatted voice, facsimile and related signals, and for the transmission of computer-generated data.

Avantek produces many microwave subsystems for satellite earth stations, including low-noise figure preamplifiers, antenna- and rack-mounted downconverters, signal power dividers and signal booster amplifiers as well as complete receiving systems for both CATV systems and broadcast quality reception of network programming for television stations. Avantek is one of the largest suppliers in the world of C-band low-noise amplifiers for satellite receiving systems and has just introduced a small diameter satellite transmit/receive earth station operating in the Ku-band for the transmission of voice, data and compressed video. The all solid-state system operates at transmission rates from 56 Kbps up to 2.048 Mbps.

Telecom Products

Microwave Digital Radios

- 2,4,6 and 18 GHz
- Common carrier and operational fixed service bands
- 24-672 voice and/or data channels

Satellite Earth Station Receiving Equipment

- Complete 24 channel CATV receivers
- Complete broadcast station receivers
- Low noise amplifiers for 4 and 12 GHz bands
- Low noise amplifiers/downconverters
- Feedline components

Uplink driver amplifiers

CARS band amplifiers

Terrestrial, point-to-point low noise and driver amplifiers

Microwave radio TWT replacement amplifiers

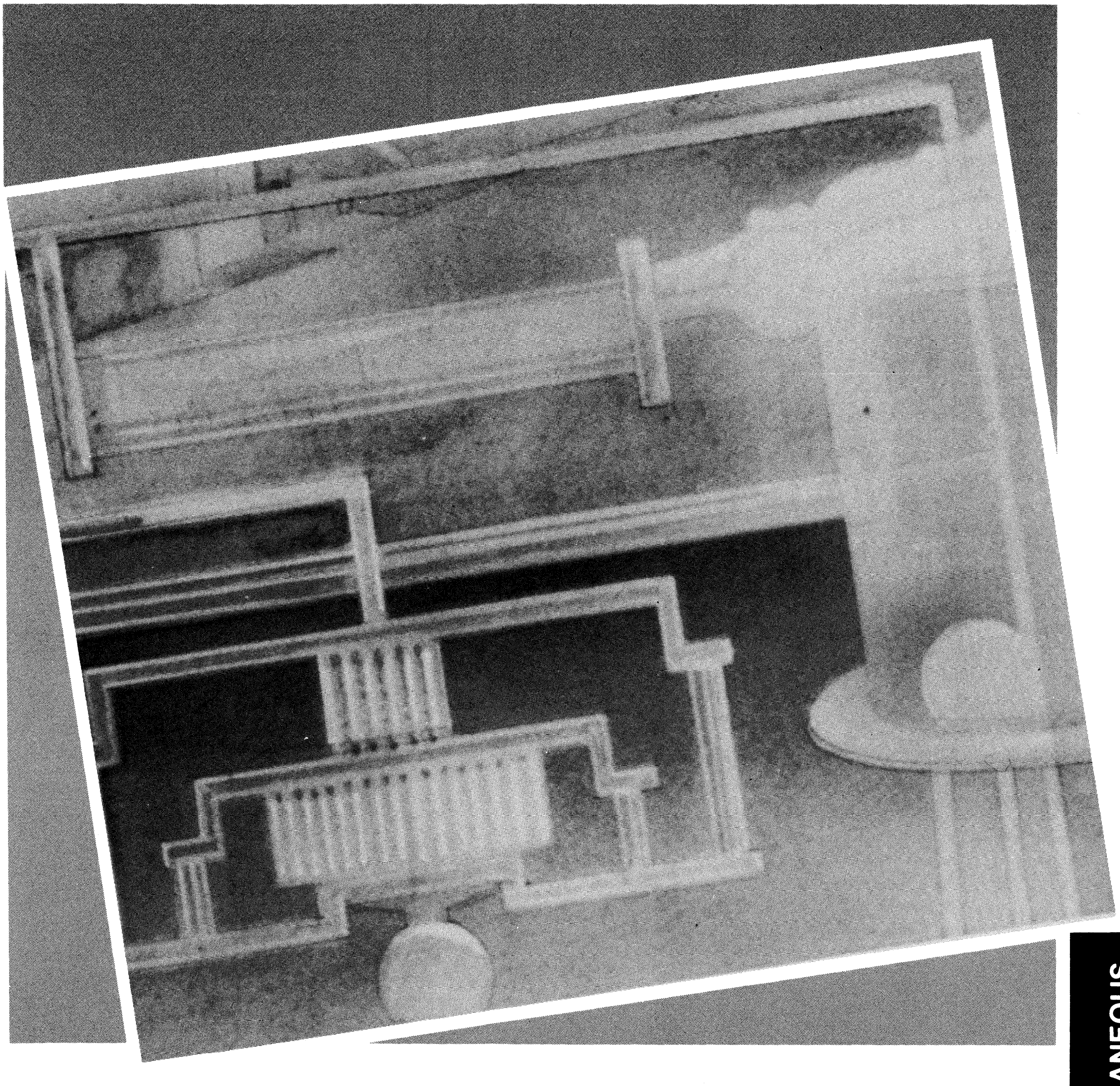
INMARSAT maritime transceiver assembly

Cellular radio amplifiers

Low noise and medium power radar band amplifiers

Small aperture satellite transmit/receive stations

Miscellaneous



MISCELLANEOUS

Avantek Quality Assurance

Avantek's Quality Assurance department operates independently of both engineering and manufacturing. Its purpose is to assure that all Avantek products as well as equipment and systems meet the rigid quality standards that Avantek is known for. Both Avantek product reliability policies and workmanship standards are continually revised to keep pace with new and improved manufacturing processes as they are instituted.

Responsibilities of the Quality Assurance Department include:

- Maintaining an effective, efficient system of quality assurance and control which meets the MIL-Q-9858A.
- Maintaining an effective liaison with our customers' quality control and source inspection personnel.
- Establishing and maintaining corporate-wide product and workmanship standards, and process specifications.
- Exercising an audit function on production processes to maintain the performance and reliability designed into every Avantek product.
- Assuring that all supplies and services procured from vendors conform to Avantek engineering and quality standards.

How To Order

Avantek semiconductor products may be ordered through any of our distributors and representatives listed on pages 227 and 228 or they may be ordered from Avantek Component Sales directly at 408-496-6710 for immediate shipment.

Warranties, Standard Terms and Conditions

Our confidence in all Avantek products' reliability and performance is such that all of our semiconductor products carry the following warranties:

1. General Warranty

Seller warrants each item manufactured by it to be free from defects in material and workmanship. In no event will the seller be liable for consequential or resulting loss or damage, whether or not due to causes covered by these warranties. (See specific product warranty below for details of warranty period and other conditions.)

2. Specific Product Warranty

All Avantek products are manufactured to high quality standards and are warranted against defects in workmanship, materials and construction and to no further extent. In no event will Avantek be liable for consequential misuse or damages. Avantek products are warranted against any above-named defects which appear within one (1) year of shipping date, and will be replaced or repaired at Avantek's discretion after engineering review of the complaint, providing the procedure outlined below is followed. This warranty is the only warranty made by the supplier and is in lieu of all other warranties, expressed or implied, except as to title, and can be amended only by a written instrument signed by an officer of Avantek. Avantek field offices or agents are not authorized to make commitments on warranty returns, but can provide liaison.

In the event that it is necessary to return products against the above warranty, the following procedure is to be followed:

A. Return authorizations are to be requested prior to return, stating model number, serial number and requested action.
   1) Units are then forwarded to Avantek, transportation prepaid.
   2) Units returned freight collect or w/o authorization will not be accepted.

Such requests should be directed to Avantek Customer Service (408) 727-0700.

B. Original product identification markings must not be removed, defaced, or altered, and the product must not have been subjected to abuse, improper installation or application, alteration, accident or negligence in use, storage, transportation or handling.

C. Return units will undergo complete test and evaluation. Replacements and/or repair will be determined only after Avantek has determined the cause of failure. All units returned are subject to a $75.00 evaluation charge when:
   1) The units meet full specifications and do not require repair, or,
   2) After evaluation, non-warranty repairs are not authorized by the customer.

D. Avantek is not responsible for failures due to excessive stresses caused by rough handling during test or installation at the user's location; nor can Avantek be responsible for damage caused by improper operation or faulty power supplies. Factory return inspection techniques can usually sort out latent defects from excessive voltages and currents with respect to credit or non-credit.

Every precaution is used at the factory to insure that every unit meets all electrical and mechanical specifications prior to shipment. Customers are asked to advise their incoming inspection and test personnel as to the precautions required in testing low power microwave components.

For any assistance, contact your nearest Avantek sales representative or Avantek, Inc., 3175 Bowers Avenue, Santa Clara, CA 95051. Telephone (408) 727-0700. TWX 910-339-9274.

3. Limitations of Liabilities

Avantek's liability on any claim of any kind, including negligence, for any loss or damage arising from, connected with, or resulting from this contract (or quotation), or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contract, shall in no case exceed the purchase price of the unit (or equipment) which gives rise to the claim.

In no event, whether as a result of breach of contract or warranty or alleged negligence, shall Avantek be liable for special or consequential damages including but not limited to, loss of profits or revenue, loss of use to the equipment or an associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, or claims of customers of the buyer for such damages.

4. Delivery

Unless otherwise specifically provided, delivery of the equipment shall be made F.O.B. point of shipment, at which time the title and risk of loss shall pass to the purchaser. Avantek shall in no way be responsible for safe arrival of the shipment. Title shall also pass to buyer regardless of any provisions for payment of freight or insurance by Avantek. Avantek shall not be liable for delays in delivery or in performance, or failure to manufacture due to causes beyond its reasonable control.

5. Terms of Payment

A. Unless otherwise specifically provided, price is payable upon shipment to buyer. Alternate terms of payment are subject to approval of Avantek.

B. If shipments are delayed by buyer, payments shall become due and payable on the date when Avantek is prepared to make shipment.

C. Equipment, held for the buyer beyond a reasonable period, shall be at the risk of the buyer and subject to warehouse charges.

D. If the financial condition of the buyer at any time does not, in Avantek's judgement, justify continuance of the work to be performed by Avantek, Avantek may require full or partial payment in advance, on a C.O.D. basis, or shall be entitled to cancel any order then outstanding and shall receive full recovery costs. If the buyer undergoes insolvency or bankruptcy, Avantek shall be entitled to cancel any outstanding order, and shall be entitled to receive reasonable reimbursement for cancellation, or work performed up to that time, providing claims are filed during the period allowed.

6. Sales or Similar Taxes

Unless otherwise stated, Avantek's prices do not include sales, use or similar taxes.

7. Cancellation

A. The buyer may cancel an order only upon written notice sixty (60) days prior to shipment, and upon payment to Avantek of any reasonable cancellation charges.

B. Orders which are cancelled prior to shipment, if standard items, are subject to a 15% restocking charge for those items already in production or in finished goods inventory awaiting shipment to buyer.

C. Orders which are cancelled prior to shipment, if those items are "special" or "custom" items designed or modified to the buyer's specifications, are essentially non-cancellable for that portion in production or in finished goods inventory awaiting shipment to the buyer, and are subject to full recovery costs.

D. Orders which are cancelled after shipment to buyer, whether standard or special, remain the property of that buyer.

8. Price Changes

Avantek reserves the right to revise and announce new prices for the products covered in this catalog. Avantek will honor the old prices if an order is received prior to revision of those prices, or prior to the expiration of a valid quotation outstanding at the time of the price change. Subsequent orders for the same equipment are subject to the revised or newly-announced prices.

9. Substitutions

Avantek reserves the right to modify the design and specifications of its products, provided that the modifications do not adversely affect the performance of such product or do not reduce the performance below contract specifications.

10. General Conditions

A. No understanding, promise, or representation and no waiver, alteration or modification of any of the provisions stated, shall be binding upon Avantek unless accepted in writing by an authorized employee of Avantek.

B. Quoted prices do not include rights to technical data nor do they include proprietary rights, company private or competitively sensitive data, unless expressly quoted as a separate item in each instance.*

11. Minimum Orders

Avantek reserves the right to invoke a minimum charge of $40. per domestic order ($100 per international order) requiring export license or documentation.

*ancillary clauses or interpretation of any unrelated provision for assession of data rights shall be void.

Avantek

3175 Bowers Ave., Santa Clara, CA 95051-7867 • General Office (408)727-0700 • Customer Service & Component Sales (408)496-6710 • TWX 910-339-9274 • TELEX 34-6337

DOMESTIC REPRESENTATIVES

Please call the Avantek representative serving your location or the office nearest you.

ALABAMA
MISSISSIPPI
TENNESSEE (WESTERN)
Beacon Electronic Associates
11309 S. Memorial Parkway, Suite G
Huntsville, AL 35803
(205) 881-5031

ARIZONA, NEVADA
Thorson Desert States
6560 N. Scottsdale Rd., Suite E-205
Scottsdale, AZ 85253
(602) 998-2444

ALASKA
CALIFORNIA (NORTHERN)
Cain-White & Company
Foothill Office Center
105 Fremont Avenue
Los Altos, CA 94022
(415) 948-6533

CALIFORNIA (SOUTHERN)
HAWAII
Cain Technology
1046 N. Tustin, Suite I
Orange, CA 92667
(714) 997-7311

Cain Technology
11701 Mississippi Ave
Los Angeles, CA 90025
(213) 477-9054

COLORADO, MONTANA & WYOMING
Thorson Rocky Mtn., Inc.
7076 S. Alton Way, Bldg. D
Englewood, CO 80112
(303) 779-0666

FLORIDA (NORTHWESTERN)
Beacon Electronics Associates
2085 U.S. Highway 19 N., Suite 300
Clearwater, FL 33575
(813) 796-2378

FLORIDA (ORLANDO Area)
Beacon Electronic Associates
235 S. Maitland, P.O. Box 1260
Maitland, FL 32751
(305) 647-3498

FLORIDA (NORTHEASTERN)
Beacon Electronic Associates
312 S. Harbor City Blvd., Suite 6
Melbourne, FL 32901
(305) 724-8010

FLORIDA (SOUTHERN)
Beacon Electronic Associates
7301 W. Palmetto Park Road
Suite C-210
Boca Raton, FL 33433
(305) 392-3500

GEORGIA, TENNESSEE (EASTERN)
Beacon Electronic Associates
6135 Barfield Road, Suite 112
Atlanta, GA 30328
(404) 256-9640

ILLINOIS (NORTHERN)
WISCONSIN (SOUTHEAST)
Dytec/Central, Inc.
315 W. University Drive
Arlington Heights, IL 60004
(312) 394-3380

ILLINOIS (SOUTHERN)
IOWA (SOUTHEASTERN)
MISSOURI (EASTERN)
Dytec/South Inc.
11649 Adie Road
Maryland Heights, MO 63043
(314) 569-2990

IOWA (SOUTHWESTERN)
KANSAS, NEBRASKA
MISSOURI (WESTERN)
Dytec/South, Inc.
8245 Nieman Road, Suite 123
Lenexa, KS 66214
(913) 888-0215

INDIANA, KENTUCKY
Dytec/Central
25 Beachway Dr., Suite A-1
Indianapolis, IN 46224
(317) 247-1316

MARYLAND, VIRGINIA
WEST VIRGINIA & DIST. OF COL.
Applied Engineering Consultants
10101-G Bacon Drive
Beltsville, MD 20705
(301) 595-5393 (Metro DC)
(301) 792-2211 (Maryland)
(800) 638-8555 (All other)

MICHIGAN
Comtel Instruments
21223 Hilltop St.
Southfield, MI 48037
(313) 358-2505

MINNESOTA
NORTH AND SOUTH DAKOTA
IOWA (NORTHERN)
WISCONSIN (Except SOUTHEASTERN)
Electronic Sales Agency
8053 Bloomington Freeway
Bloomington, MN 55420
(612) 884-8291

NEW ENGLAND STATES
R.J. Sickles Associates
175 Bedford Street, Suite 12
Lexington, MA 02173
(617) 862-5100

NEW JERSEY (NORTHERN)
NEW YORK (METROPOLITAN)
Technical Marketing Associates
433 Essex St.
Hackensack, NJ 07601
(201) 342-4008

NEW MEXICO
TEXAS (EL PASO Area)
Thorson Desert States
9301 Indian School N.E., Suite 112
Albuquerque, NM 87112
(505) 293-8555

NEW YORK (UPPER STATE)
Robtron
53½ Jordan Street
Skaneateles, NY 13152
(315) 685-5731

NORTH & SOUTH CAROLINA
Beacon Electronics Associates
6316 Angus Drive
Raleigh, NC 27612
(919)787-0330

OHIO (NORTHERN)
Comtel Instruments Company
5387 Avion Park Drive
Cleveland, OH 44143
(216) 442-8080

OHIO (SOUTHWESTERN)
Comtel Instruments Company
1717 Big Hill Road, Suite 6A
Dayton, OH 45429
(513) 298-7573

OHIO (SOUTHEASTERN)
Comtel Instruments Company
5006 Cemetary Road
Hilliard, OH 43026
(614) 876-8305

OREGON
Thorson Northwest
6700 S.W. 105th Avenue, Suite 104
Beaverton, OR 97005
(503) 644-5900

PENNSYLVANIA (WESTERN)
Comtel Instruments Company
#9 Parkway Center, Suite 180
Pittsburgh, PA 15220
(412) 922-5720

PENNSYLVANIA (EASTERN)
NEW JERSEY (SOUTHERN)
DELAWARE
Eastern Instrumentation
of Philadelphia
Neshaminy Plaza
Building 2, Suite 124
Street Road & Bristol Pike
Bensalem, PA 19020
(215) 245-6660

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OKLAHOMA, ARKANSAS
LOUISIANA (NORTHERN)
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4445 Alpha Road
Dallas, TX 75234
(214) 233-5744

TEXAS (SOUTHWESTERN)
Thorson Southwest
300 E. Huntland Drive, Suite 108
Austin, TX 78752
(512) 451-7527

TEXAS (SOUTHEASTERN)
LOUISIANA, (SOUTHERN)
Thorson Southwest
6633 Hillcroft, Suite 105
Houston, TX 77081
(713) 771-3504

UTAH, IDAHO (SOUTHEASTERN)
Thorson Rocky Mtn., Inc.
Bank of Utah Bldg., Suite A
2309 South Redwood Road
West Valley City, UT 84119
(801) 973-7969

WASHINGTON
IDAHO (NORTHWESTERN to Boise)
Thorson Northwest
12301 N.E. 10th Place
Bellevue, WA 98005
(206) 455-9180

INTERNATIONAL REPRESENTATIVES

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35 Harris Road
Normanhurst,
New South Wales 2076
Australia
Phone: (02) 483508

Graphic Electronic Industries Pty. Ltd.
P.O. Box 147
20 Fullarton Rd.
Norwood, So. Australia 5067
Phone: (08) 42 6655

BELGIUM
Simac Electronics S.P. RPL
Rue du Progres, 52 Boite 2
1000 Brussels, Belgium
Phone: 32-2-2192453

CANADA
R.D.B. Sheppard Agencies Ltd.
P.O. Box 8
Georgetown, Ontario L7G 4T1, Canada
Phone: (416) 877-9846

FRANCE
Serrgop
4, rue Paul Bert
92150 Suresnes, France
Phone: 1-506-33-03

HONG KONG
Enrich Trading Company
240, 7 Seas Shopping Centre
121 Kings Road
North Point, Hong Kong

INDIA
Hinditron Services Pvt. Ltd.
69-A.L. Jagmohandas Marg
Bombay 400 006, India
Phone: 8221529 or 8229677

INDONESIA
P.T. Subur Sakti Putera
J1 Cideng Timur 68A, PO Box 4467 Jkt.
Jakarta Pusat, Indonesia
Phone: 359153 or 359764

ISRAEL
M.T.I. Engineering Ltd.
182 Ben Yehuda Street
P.O. Box 16349
Tel-Aviv 61162, Israel
Phone: (03) 249273

ITALY
Sistrel Elettronica Micro-Onde S.P.A.
Via Luigi Chiarelli N. 19
00137 Rome, Italy
Phone: (06) 827-8551-2-3-4

JAPAN
Sogo Electronics, Inc.
3-13-15 Minami Karasuyama
Setagaya-KU
Tokyo, 157 Japan
Phone: (03) 309-5442

KOREA
Elim Commercial Co. Ltd.
K.P.O. Box 1681
Seoul, 110, Korea
Phone: 742-4753 or 743-9987

THE NETHERLANDS
Simac Electronics B.V.
Veenstraat 20
5503 HR Veldhoven
The Netherlands
Phone: 31-40-533725

PHILLIPINES
"Y" Engineering Corporation
2212 Marconi Street
P.O. Box 3355
Makati, Metro Manila
Phillipine Islands
Phone: 89-51-28

REPUBLIC OF SOUTH AFRICA
South Continental Devices (Pty.) Ltd.
P.O. Box 56420 Pinegowrie, 2123
Republic of South Africa
5th Floor Randover House
Dover Street
Randburg, Republic of South Africa
Phone: 011-789-2400

SWEDEN, NORWAY
FINLAND, DENMARK
Visitron AB
P.O. Box 6063,
Korssgatan 40
S-16206 Vaellingby, Sweden
Phone: 46-8-38-01-30

SWITZERLAND
Walter Electronics AG
Bruehlwiesenstrasse 17
CH-9545 Waengi
Switzerland
Phone: (41) 54 51 22 77

TAIWAN
Schmidt Electronics
6th Floor, Cathay Min-Sheng
Com. Building
344, Min-Sheng East Road
Taipei 104 Taiwan, R.O.C.
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THAILAND
G Simon Radio Co., Ltd.
30 Patpong Avenue
Bangkok, Thailand
Phone: 2340991-3

UNITED KINGDOM
Wave Devices
9 Betterton Street
Covent Garden
London WC 2H 9BS, England
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YUGOSLAVIA
Belram S.A.
83 Avenue des Mimosas
1150 Brussels, Belgium
Phone: 34 33 32

9/7/84

AVANTEK DISTRIBUTORS

These stocking distributors carry the following Avantek products:

- **Low-cost amplifiers in TO-12 packages (GPD)**
- **Drop-in replacements for MWA IF amplifiers**
- **High-performance amplifiers in TO-8 packages (UTO)**
- **Avantek™ thin-film amplifiers to X-Band**
- **Varactor tuned oscillators**
- **Mixers**
- **A complete line of silicon and GaAs FET transistors**
- **Internally matched power FETs**
- **MODAMP™ monolithic silicon amplifiers**
- **Related accessories (PC boards, cases, and hardware)**

APPLIED SPECIALTIES, INC.

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Beltsville, MD 20705
301/595-5393 (Metro D.C.)
301/792-2211 (Maryland)
800/638-8555 (Virginia, W. Virginia)

COMPONENT DISTRIBUTORS, INC.

6850 North West 20th Avenue
Ft. Lauderdale, FL 33309
305/971-4950

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Huntsville, AL 35803
205/883-7501

Wardlaw Building
2008 Hillsborough
Raleigh, NC 27607
919/834-9465

6264 Crooked Creek Drive, Suite 2
Norcross, GA 30092
404/441-3320

14 Office Park Drive, Suite 200
Little Rock, AR 72211
501/227-6278

PEAK BRANCH OFFICES:

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Indianapolis, IN 46224
317/247-1316

890 Elm Grove Rd., Suite 207
Elm Grove, WI 53122
414/784-9686

PEN STOCK COMPANY

Foothill Office Center
105 Fremont Avenue
Los Altos, CA 94022
415/948-6552

SERTEK INC.

11701 Mississippi Avenue
Los Angeles, CA 90025
213/477-9051

1046 N. Tustin, Suite "I"
Orange, CA 92667
714/997-7311 or 7314
619/224-6911 (San Diego)

SPIRIT ELECTRONICS, INC.

6560 N. Scottsdale Road, Suite F-205
Scottsdale, AZ 85253
602/998-1533