Common Components

Attenuators - in coaxial and stripline form

Splitters - combiners

Directional couplers, isolators, circulators

Filters

Diode Detectors

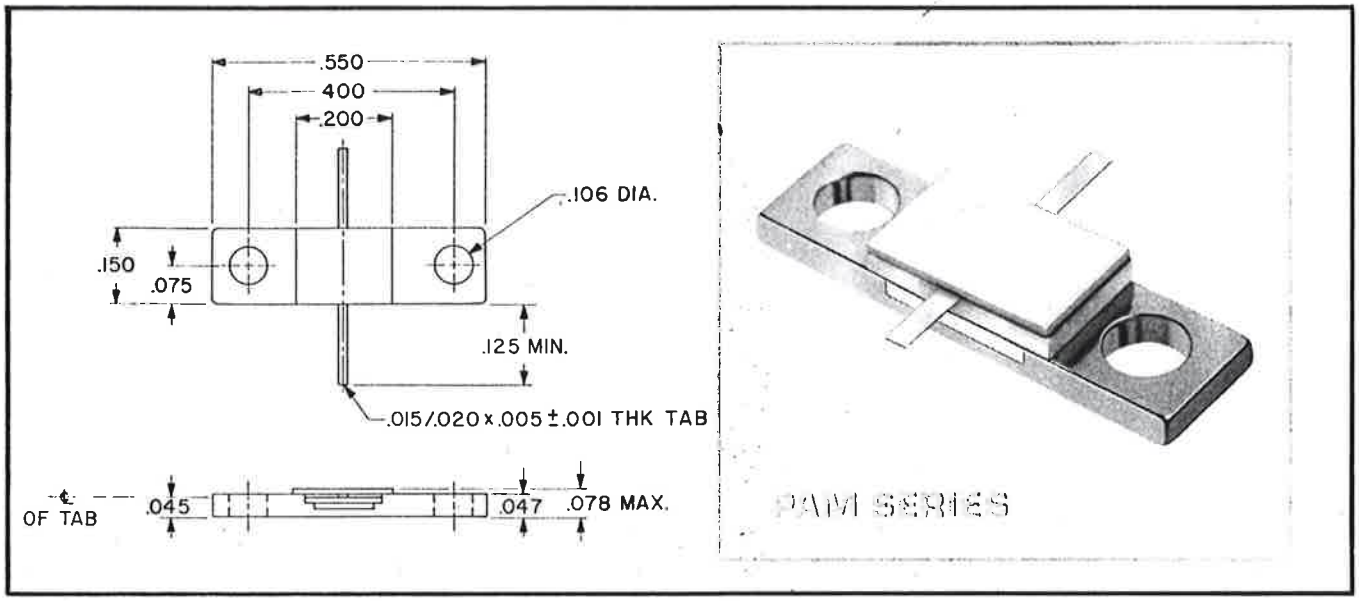
Amplifiers

Modulators (mixers)

Step-Recovery diodes (comb generators)

DROP-IN MICROSTRIP attenuators

1 TO 20 dB • D C TO 12.4 GHz

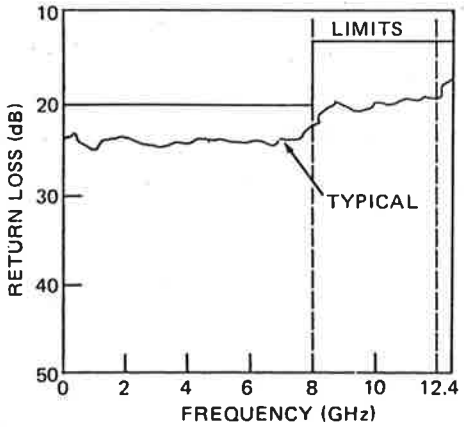


GENERAL SPECIFICATIONS

Frequency Range:	DC to 12.4 GHz
Impedance:	50 ohms
Attenuation Stability:	0.0001 dB/dB/°C
*Attenuation Accuracy:	1-10 dB - ±0.5 dB 11-20 dB - ±0.75 dB
*VSWR (Max.):	DC - 4 GHz - 1.30:1 4 - 12.4 GHz - 1.50:1
Input Power:	1 watt @ 25°C, derate to 0 watts @ 150°C
Operating Temperature:	-65°C + 150°C
Flange:	Kovar, Nickel Plated per QQ-N-290
Tabs:	Beryllium Copper, Gold Plated per MIL-G-45204
Element and Cover:	Alumina Ceramic
Resistive Element:	Proprietary Thin Film

* Measured in .025" thick microstrip(ϵ = 10)

Note: Unless otherwise specified all tolerances ± .010.



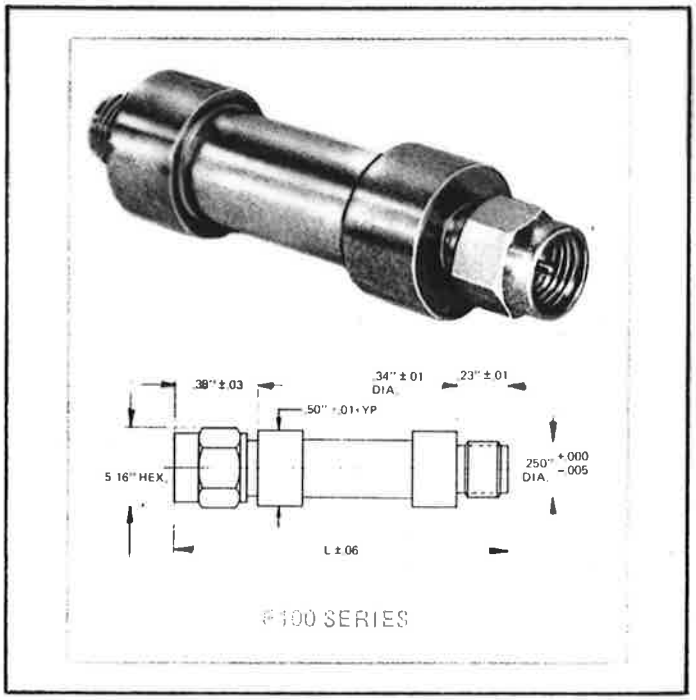
ORDERING INFORMATION

These Microstrip Attenuators are available in 1 dB increments from 1 through 20 dB. When ordering, to specify the correct part number for the desired attenuation value, add the attenuation value to the basic series designation.

EXAMPLE: PAM - 10
Basic Series — Desired dB Value

KDI ELECTRONICS, INC.
Pyrofilm & Engelmann Divisions
60 South Jefferson Road, Whippany, N.J. 07981 · TEL (201) 887-8100 · TWX (710) 986-8220 · FAX (201) 887-4645

LOW PASS filters
0.25 - 12.4 GHz



F100 SERIES LOW PASS

GENERAL SPECIFICATIONS

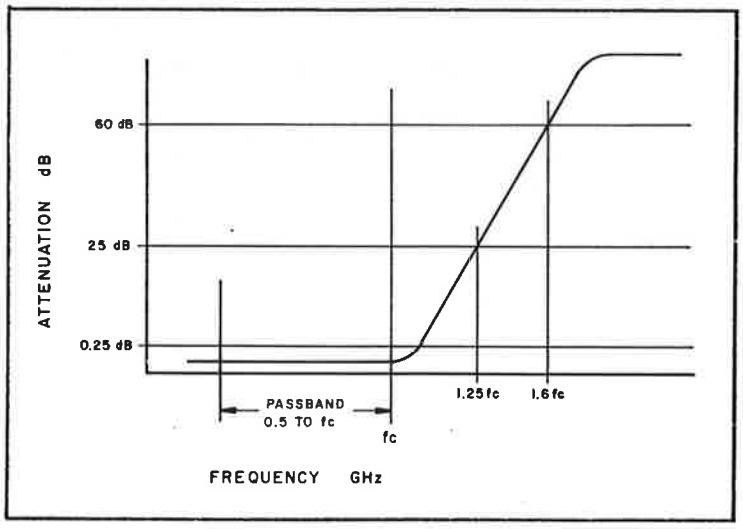
Minimum Rejection:	25 db @ 1.25 fc
	50 db @ 1.5 fc
	60 db @ 1.6 fc
Impedance:	50 Ohms
Connectors:	Male and Female (Bi-Directional)
Specify Type:	SMA, TNC, BNC, or Type N
Temperature Range:	-55 to +125°C
Power:	100 WCW, 5 KW Peak

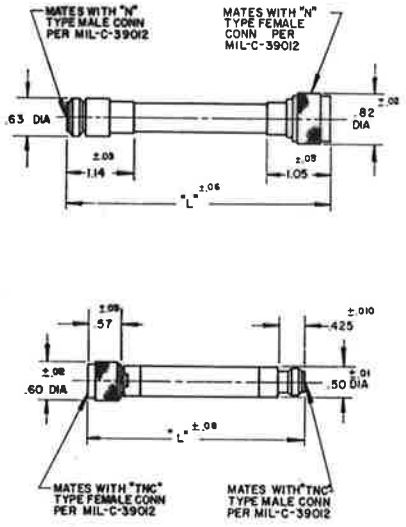
F100 Series Characteristics

Pass-band (GHz)	"L" (IN.)	Model No.*	Max. VSWR**	Max. Ins. Loss (db)	60 db Min. (GHz)
0.25-0.50	12.51	F105	1.35	0.25	.88-3.0
0.38-0.75	6.59	F1075	1.35	0.25	1.2-4.0
0.50-1.00	6.62	F110	1.35	0.25	1.6-6.0
0.63-1.25	5.88	F1125	1.35	0.25	2.0-8.0
0.75-1.50	5.01	F115	1.35	0.25	2.4-9.0
0.88-1.75	4.40	F1175	1.35	0.25	2.8-10.0
1.00-2.00	3.95	F120	1.35	0.25	3.2-11.0
1.50-3.00	3.94	F130	1.35	0.25	4.8-12.0
2.00-4.00	3.15	F140	1.35	0.25	6.4-16.0
2.50-5.00	2.67	F150	1.35	0.25	8.0
3.00-6.00	2.35	F160	1.35	0.25	9.6
3.50-7.00	2.12	F170	1.35	0.25	11.2
4.00-8.00	1.95	F180	1.35	0.25	12.8
4.50-9.00	1.82	F190	1.40	0.30	14.4
DC-12.4	3.57	F1240**	1.50	0.4	18

Note: Lengths shown are for SMA. **Type SMA or N only.
*Add a letter suffix to the model number to specify the connector.

11 SECTION LOW PASS
STANDARD CUT OFF CHARACTERISTICS





KDI ELECTRONICS, INC.
Pyrofilm & Engelmann Divisions
60 South Jefferson Road, Whippany, N.J. 07981 · TEL (201) 887-8100 · TWX (710) 986-8220 · FAX (201) 887-4645

BANDPASS 10.7 to 70 MHz

PIF
PBP
PBLP

NIF
NBP
NBLP

constant impedance

MODEL NO.	CENTER FREQ. MHz	PASSBAND, MHz (loss < 1dB)	STOP BANDS (loss < 10 dB) at MHz	STOP BANDS (loss > 20 dB) at MHz	VSWR, 1.3:1, Typ. TOTAL BAND, MHz	CASE STYLE Note B	CONNECTORS	PRICE $ (note 2a) Qty. (1-9)
_IF-21.4	21.4	18-25	4.9 & 85	1.3 & 150	DC-220	V	cs	14.95
_IF-30	30	25-35	7 & 120	1.9 & 210	DC-330	V	cs	14.95
_IF-40	42	35-49	10 & 168	2.6 & 300	DC-400	V	cs	14.95
_IF-50	50	41-58	11.5 & 200	3.1 & 350	DC-440	V	cs	14.95
_IF-60	60	50-70	14 & 240	3.8 & 400	DC-500	V	cs	14.95
_IF-70	70	58-82	16 & 280	4.4 & 490	DC-550	V	cs	14.95

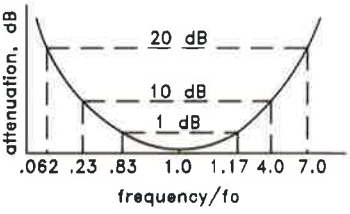
For connector selection, add prefix letter P, B, N or S to _IF where applicable (see note 2)

elliptic response

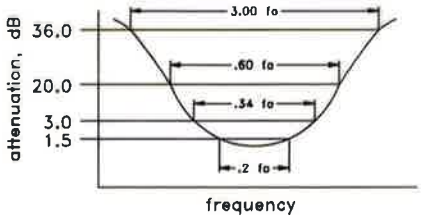
MODEL NO.	CENTER FREQ. MHz	PASSBAND, MHz I.L. 1.5 dB Max. MHz	3 dB BANDWIDTH Typical MHz	STOP BANDS (I. Loss > 20 dB) at MHz	STOP BANDS (I. loss > 35 dB) at MHz	PASSBAND VSWR Max.	STOP BAND VSWR Typ.	CASE STYLE Note B	CONNECTORS	PRICE $ (note 2b) Qty. (1-9)
_BP-10.7	10.7	9.5-11.5	8.9-12.7	7.5 & 15	0.6 & 50-1000	1.7:1	16:1	V	cr	18.95
_BP-21.4	21.4	19.2-23.6	17.9-25.3	15.5 & 29	3.0 & 80-1000	1.7:1	16:1	V	cr	18.95
_BP-30	30	27.0-33.0	25-35	22 & 40	3.2 & 99-1000	1.7:1	16:1	V	cr	18.95
_BP-60	60	55.0-67.0	49.8-70.5	44 & 79	4.6 & 190-1000	1.7:1	16:1	V	cr	18.95
_BP-70	70	63.0-77.0	58.0-82.0	51 & 94	6.0 & 193-1000	1.7:1	16:1	V	cr	18.95

For connector selection, add prefix letter P, B, N or S to _BP where applicable (see note 2)

BANDPASS, CONSTANT IMPEDANCE
TYPICAL FREQUENCY RESPONSE



BANDPASS, ELLIPTICAL
TYPICAL FREQUENCY RESPONSE



NSN GUIDE

MCL NO.	NSN
SIF-30	5915-01-464-8971

000530

LOW PASS, FLAT TIME DELAY DC to 1.87 GHz

BBLP
BIF
BBP

SBLP
SIF
SBP

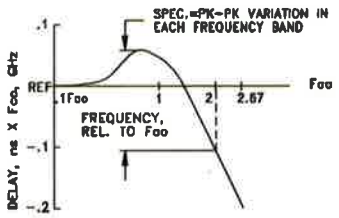
MODEL NO.	PASSBAND, MHz (loss < 1.2 dB) Min.	fco, MHz (loss 3dB) Nom.	STOP BAND, MHz loss > 10 dB	STOP BAND, MHz loss > 20 dB	VSWR DC-0.2fco $\bar{x}$	VSWR DC-0.6fco $\bar{x}$	GROUP DELAY VARIATION, ns DC-fco $\bar{x}$	GROUP DELAY VARIATION, ns DC-2fco $\bar{x}$	GROUP DELAY VARIATION, ns DC-2.67fco $\bar{x}$	CASE STYLE Note B	CONNECTION	PRICE $ (note 2c) Qty. (1-9)
	_BLP-39	DC-23	39	78-117	117	1.3:1	2.3:1	0.70	4.0	5.00	▽	cr	19.95
	_BLP-117	DC-65	117	234-312	312	1.3:1	2.4:1	0.35	1.4	1.90	▽	cr	19.95
	_BLP-156	DC-94	156	312-416	416	1.3:1	1.1:1	0.30	1.1	1.50	▽	cr	19.95
	_BLP-200	DC-120	200	400-534	534	1.6:1	1.9:1	0.40	1.3	1.60	▽	cr	19.95
	_BLP-300	DC-180	300	600-801	801	1.25:1	2.2:1	0.20	0.6	0.80	▽	cr	19.95
	_BLP-467	DC-280	467	934-1246	1246	1.25:1	2.2:1	0.15	0.4	0.55	▽	cr	19.95
▼	_BLP-933	DC-560	933	1866-2490	2490		2.2:1	0.09	0.2	0.28	▽	--	38.95
▼	_BLP-1870	DC-850	1870	3740-5000	5000	1.45:1	2.9:1	0.05	0.1	0.15	▽	--	38.95

For connector selection, add prefix letter P, B, N, or S to _BLP where applicable (see note 2)

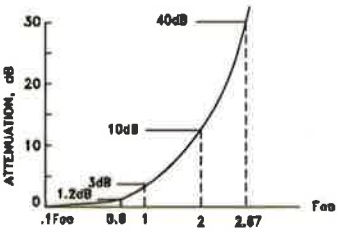
features

- Flat group delay for low pulse distortion.
- Delay and selectivity are both controlled by design.
- Wide selection of cutoff frequencies, 48-to-1 range. Custom Fco values are available.
- Choice of pin package or connectorized models.

TYPICAL GROUP DELAY



TYPICAL FREQUENCY RESPONSE INSERTION LOSS



NOTES:

* Connection for plug-in models (PIF, PBP, PBLP)
▼ _BLP-933 AND _BLP-1870 available only with N and SMA connectors.
▽ Four different case styles available:
For plug-in models, case style A01
SMA connector models, case style FF99
BNC connector models, case style FF55
N-type connector models, case style FF57

A. General Quality Control Procedures, Environmental Specifications, HI-Rel and MIL description are given in section 0, see "Mini-Circuits Guarantees Quality" article.
B. Connector types and case mounted options, case finishes are given in section 0, see "Case styles & outline drawings".
C. Prices and specifications subject to change without notice.
1. Absolute maximum power, voltage and current rating:
1a. RF power, 0.5 Watt
2. 2a. Price for PIF-series only, SIF $38.95, BIF $36.95, NIF $39.95
2b Price for PBP-series only, SBP $42.95, BBP $40.95, NBP $43.95
2c. Price for PBLP-series only, SBLP $38.95, BBLP $36.95, NBLP $39.95
3. Models are available with mate/ female coax connectors, for other configurations and inter-series versions consult factory. See section 0, case styles and outline drawings.
4. All filters, except pin units (PIF, PBP and PBLP), are non-hermetic.

pin connections

see case style outline drawings

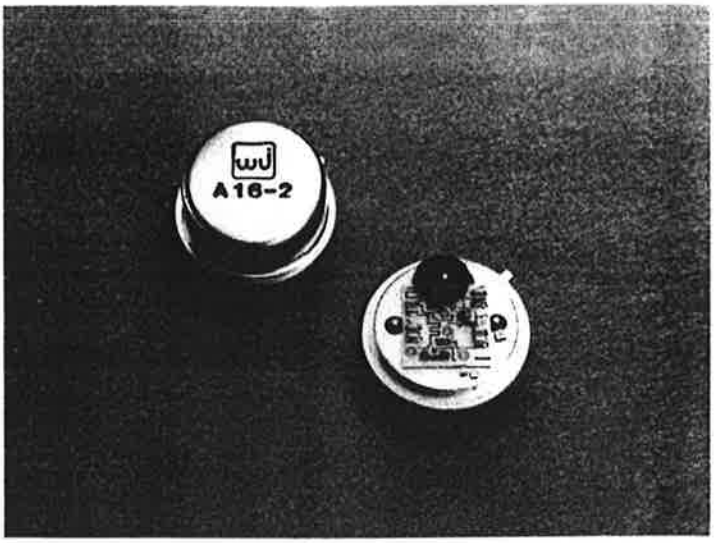
PORT	cr	cs
INPUT	1	1
OUTPUT	8	6
GND	2,3,4,5,6,7	2,3,4,5,7,8

000331

WJ-A16-2

10 TO 1200 MHz TO-8 CASCADABLE AMPLIFIER

- LOW NOISE: 3.5 dB (TYP)
- HIGH EFFICIENCY: 15 mA (TYP) AT 5 VOLTS
- GOOD DYNAMIC RANGE: 102.5 dB (TYP) IN 1 MHz BW
- LOW VSWR: <1.5:1 (TYP)



Specifications

Characteristic	Typical	Guaranteed[1] 0° - 50°C	Guaranteed[1] -54° - +85°C
Frequency (Min.)	5 - 1300 MHz	10 - 1200 MHz	10 - 1200 MHz
Small Signal Gain (Min.)	13.0 dB	12.0 dB	11.5 dB
Gain Flatness (Max.)	±.2 dB	±.5 dB	±.7 dB
Noise Figure (Max.)	3.5 dB	4.0 dB	4.5 dB
Power Output at 1 dB Compression (Min.)	6.0 dBm	5.0 dBm	4.5 dBm
VSWR (Max.) Input/Output	<1.5:1	1.9:1	2.0:1
DC Current (Max.) at +5 Volts	15 mA	17 mA	18 mA

Notes: 1. Measured in a 50-ohm system at +5 VDC nominal.

Typical Intermodulation Performance at 25°C

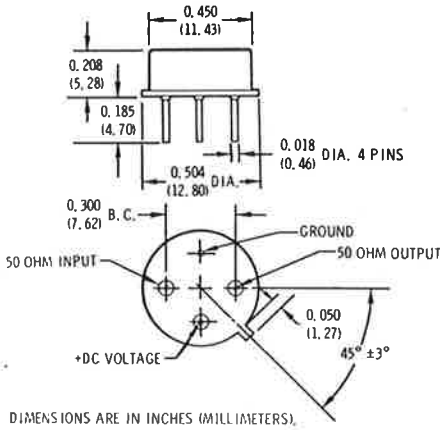
Second Order Harmonic Intercept Point . . . . . +34 dBm (Typ.)
Second Order Two Tone Intercept Point . . . . . +28 dBm (Typ.)
Third Order Two Tone Intercept Point . . . . . +18 dBm (Typ.)

Absolute Maximum Ratings

Ambient Operating Temperature . . . . . -54°C to +100°C
Storage Temperature . . . . . -62°C to +125°C
Maximum Case Temperature . . . . . +125°C
Maximum DC Voltage . . . . . +8 Volts
Maximum Continuous RF Input Power . . . . . +13 dBm
Maximum Short Term RF Input Power (1 Minute Max.) . . . . . 50 Milliwatts
Maximum Peak Power . . . . . .5 Watt
(3 μsec Max.)
"S" Series Burn-In Temperature . . . . . 125°C

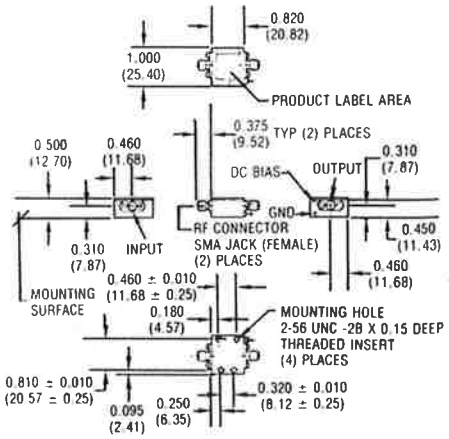
Outline Drawings

A16 - 2



DIMENSIONS ARE IN INCHES (MILLIMETERS).

CA16 - 2



DIMENSIONS ARE IN INCHES (MILLIMETERS).

*WJ - CA16 - 2 is standard WJ - A16 - 2 installed in miniature SMA connector housing and guaranteed over 0°C to 50°C temperature range.

MSA-1120 MODAMP™ Cascadable Silicon Bipolar Monolithic Microwave Integrated Circuit Amplifiers

Absolute Maximum Ratings

Parameter	Absolute Maximum[1]
Device Current	100 mA
Power Dissipation[2,3]	650 mW
RF Input Power	+13 dBm
Junction Temperature	200°C
Storage Temperature	–65°C to 200°C

Thermal Resistance[2,4]: θ_{jc} = 60°C/W

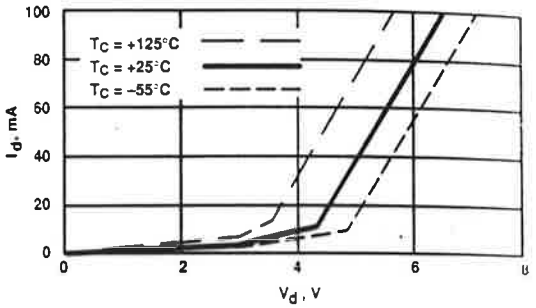
Notes:

1. Permanent damage may occur if any of these limits are exceeded.
2. T_{CASE} = 25°C
3. Derate at 16.7 mW/°C for T_C > 161°C.
4. The small spot size of this technique results in a higher, though more accurate determination of θ_{jc} than do alternate methods. See MEASUREMENTS section "Thermal Resistance" for more information.

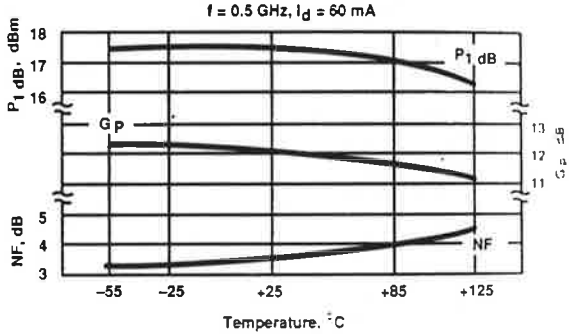
Typical Performance, T_A = 25°C, Z_O = 50 Ω

(unless otherwise noted)

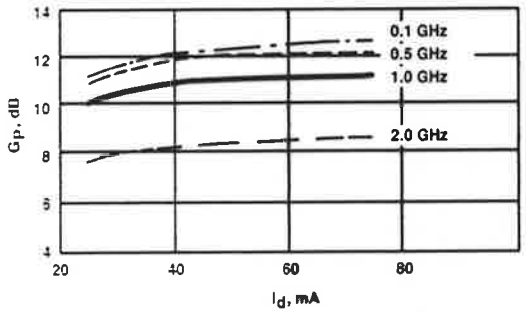
DEVICE CURRENT vs. VOLTAGE



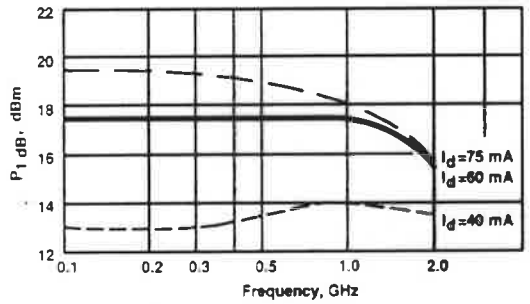
OUTPUT POWER @ 1 dB GAIN COMPRESSION
NOISE FIGURE AND POWER GAIN vs. CASE TEMPERATURE
f = 0.5 GHz, I_d = 60 mA



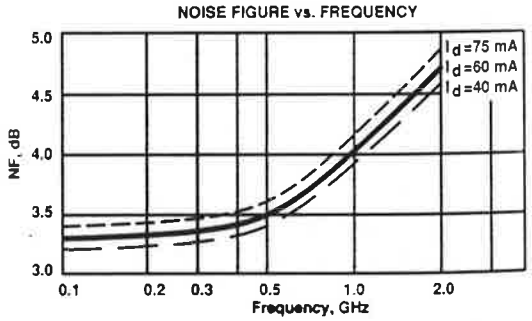
POWER GAIN vs. CURRENT



OUTPUT POWER @ 1 dB GAIN COMPRESSION vs. FREQUENCY



NOISE FIGURE vs. FREQUENCY



Typical Scattering Parameters: Z_O = 50 Ω

T_A = 25°C, I_d = 60 mA

Freq. MHz	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	k
0.5	.78	–21	19.6	9.53	168	–25.1	.057	50	.79	–21	0.51
5.0	.19	–72	13.8	4.91	165	–16.8	.144	11	.19	–72	0.98
25.0	.05	–56	12.9	4.44	174	–16.5	.149	3	.06	–75	1.08
50.0	.04	–52	12.5	4.23	174	–16.1	.156	2	.04	–79	1.08
100.0	.04	–56	12.5	4.22	172	–16.2	.155	1	.04	–78	1.09
200.0	.05	–72	12.4	4.19	165	–16.1	.157	1	.06	–91	1.08
300.0	.07	–84	12.4	4.15	158	–16.0	.159	2	.09	–101	1.07
400.0	.09	–96	12.3	4.10	151	–15.9	.161	2	.11	–109	1.06
500.0	.10	–105	12.1	4.04	144	–15.8	.163	3	.13	–117	1.05
600.0	.12	–113	12.0	3.98	137	–15.6	.166	3	.16	–124	1.04
700.0	.14	–120	11.8	3.89	131	–15.4	.169	2	.18	–130	1.03
800.0	.15	–127	11.6	3.80	124	–15.2	.173	2	.20	–136	1.01
900.0	.17	–134	11.4	3.71	118	–15.0	.178	1	.22	–142	1.00
1000.0	.19	–140	11.1	3.60	112	–14.8	.181	2	.24	–148	0.99
1500.0	.25	–167	9.8	3.10	83	–14.0	.200	–3	.31	–174	0.95
2000.0	.31	171	8.4	2.64	58	–13.3	.216	–10	.35	163	0.95
2500.0	.35	157	7.3	2.31	39	–12.8	.228	–16	.36	148	0.96
3000.0	.40	140	6.1	2.02	19	–12.5	.236	–23	.36	134	0.99

A model for this device is available in the DEVICE MODELS section.

HEWLETT PACKARD

AT-01635
Up to 4 GHz General Purpose Silicon Bipolar Transistor

Features

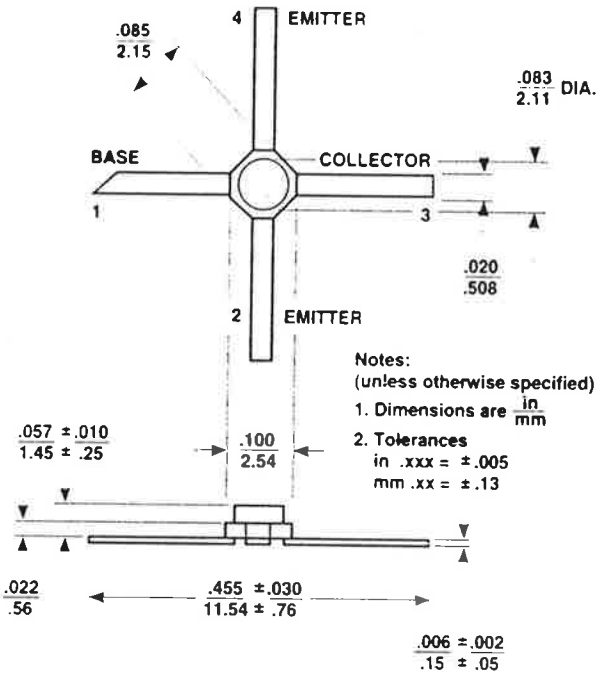
- 22.0 dBm typical $P_{1\,dB}$ at 2.0 GHz
- 9.5 dB typical $G_{1\,dB}$ at 2.0 GHz
- High Gain-Bandwidth Product: 7.0 GHz typical f_T
- Cost Effective Ceramic Microstrip Package

Description

The AT-01635 is a high performance NPN silicon bipolar transistor housed in a cost effective, microstrip package. This device is designed for use in medium power, wide band amplifier applications operating over VHF, UHF and microwave frequencies.

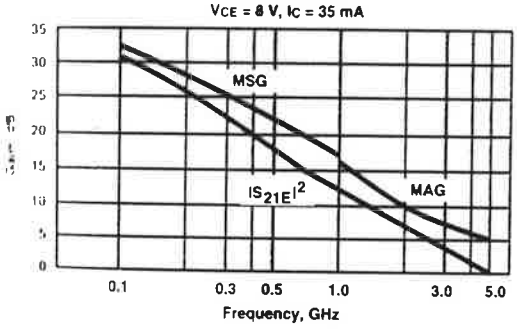
Excellent device uniformity, performance and reliability are produced by the use of ion-implantation, self-alignment techniques, and gold metallization in the fabrication of these devices.

35 micro-X Package



INSERTION POWER GAIN, MAXIMUM AVAILABLE GAIN AND MAXIMUM STABLE GAIN vs. FREQUENCY

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



Electrical Specifications, T_A = 25°C

Symbol	Parameters and Test Conditions		Units	Min.	Typ.	Max.
	Insertion Power Gain: V_{CE} = 8 V, I_C = 35 mA	f = 1.0 GHz f = 2.0 GHz	dB	11.0	12.0 6.5	
	Power Output @ 1 dB Gain Compression: V_{CE} = 8 V, I_C = 60 mA	f = 2.0 GHz	dBm		22.0	
	1 dB Compressed Gain: V_{CE} = 8 V, I_C = 60 mA	f = 2.0 GHz	dB		9.5	
	Optimum Noise Figure: V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz	dB		3.0	
	Gain @ NF_O: V_{CE} = 8 V, I_C = 35 mA	f = 2.0 GHz	dB		10.0	
	Gain Bandwidth Product: V_{CE} = 8 V, I_C = 35 mA		GHz		7.0	
	Forward Current Transfer Ratio: V_{CE} = 8 V, I_C = 35 mA			30	150	300
	Collector Cutoff Current: V_{CB} = 8 V		μA			0.2
	Emitter Cutoff Current: V_{EB} = 1 V		μA			2.0
	Collector Base Capacitance[1]: V_{CE} = 8 V, f = 1 MHz		pF		0.8	

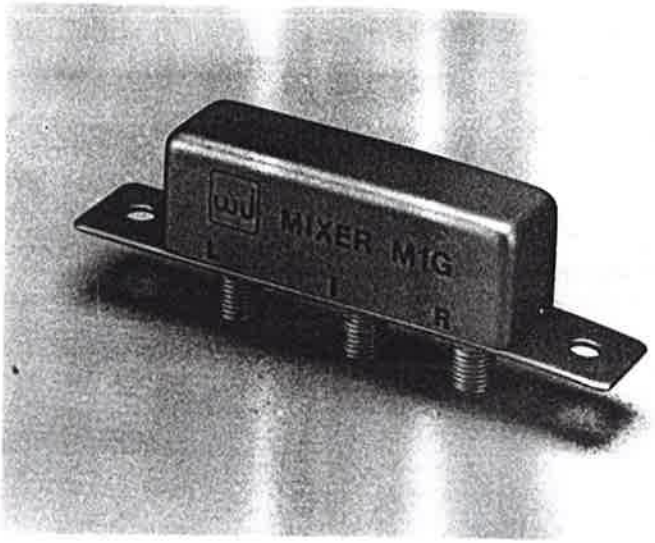
[1] For this test, the emitter is grounded.

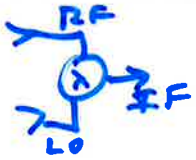
WJ-M1G

DOUBLE-BALANCED MIXER

LO, RF } 1.0 TO 4.2 GHz
IF DC TO 1 GHz

- HIGH ISOLATION: > 40 dB (TYP.)
- LOW NOISE FIGURE: 5.3 dB (TYP.)
- HERMETICALLY SEALED





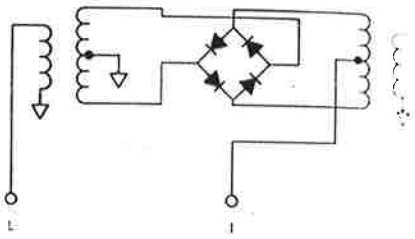
$(\omega_{RF} - \omega_{LO}) + (\omega_{RF} + \omega_{LO})$

Guaranteed Specifications [1]

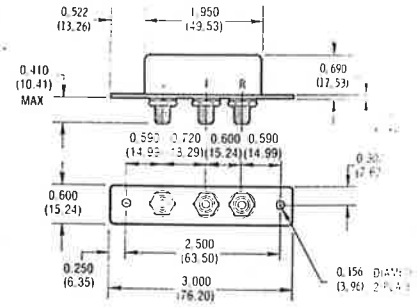
Characteristics	Min.	Max.	Test Condition
SSB Conversion Loss		7.5 dB	f_L & f_R 1.5 to 4.2 GHz, f_I 10 to 1 GHz
		8.5 dB	f_L & f_R 1.0 to 1.5 GHz, f_I 10 to 500 MHz
SSB Noise Figure		7.5 dB	f_L & f_R 1.5 to 4.2 GHz, f_I 30 MHz to 1 GHz
		8.5 dB	f_L & f_R 1.0 to 1.5 GHz, f_I 30 MHz to 500 MHz
Isolation			
f_L at R	30 dB		f_L 1.0 to 4.2 GHz
f_L at I	20 dB		

Note:
1. Measured in a 50-ohm system with f_L at +7 dBm. Downconverter application only unless otherwise specified. The I-port frequency range extends to DC for phase detection, pulse modulation, or attenuator applications. I-port VSWR degrades from a 50-ohm system at low IF.

Schematic Diagram



Outline Drawing



DIMENSIONS ARE IN INCHES (MILLIMETERS)

Absolute Maximum Ratings

Storage Temperature	-65°C to +100°C
Operating Temperature	-54°C to +100°C
Peak RF Input Power	50 mW
Peak Input Current at 25°C	50 mADC

Weight 31 grams (1.1 oz.) Maximum

Connectors SMA Female

FREQUENCY TRANSLATOR $(\omega_{RF}, \omega_{LO}) \Rightarrow$

-OR-

PHASE DETECTOR $(\omega_{RF} = \omega_{LO})$

-OR-

AMPLITUDE MODULATOR

OR

BI-PHASE MODULATOR

HEWLETT PACKARD

Silicon Bipolar MMIC 5 GHz Active Double Balanced Mixer/IF Amp

Technical Data

IAM-82008

Features

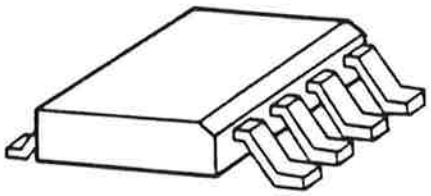
- **RF-IF Conversion Gain: 15 dB from 0.05-5 GHz**
- **IF Conversion Gain from DC to 2 GHz**
- **IF Output P_{1dB}: +8 dBm Typical**
- **Single Polarity Bias Supply: V_{CC} = 7 to 13 V**
- **Load Insensitive Performance**
- **Conversion Gain Flat over Temperature**

Description

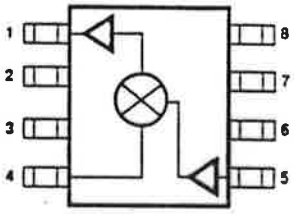
Hewlett-Packard's IAM-82008 is a complete moderate-power double-balanced active mixer housed in a miniature low cost surface mount package. It is designed for narrow or wide bandwidth commercial and industrial applications having RF inputs up to 5 GHz. Operation of RF and LO frequencies below 50 MHz can be achieved using optional external capacitors to ground. The IAM-82008 is particularly well suited for applications that require load-insensitive conversion gain and good spurious signal suppression and moderate dynamic range with low LO power. Typical applications include frequency down-conversion, up-conversion, modulation, demodulation, and phase detection. Markets include fiber-optics, GPS satellite navigation, mobile radio, and communications transmitters and receivers.

The IAM series of Gilbert multiplier-based frequency converters is fabricated using Hewlett Packard's 10 GHz f_T 25 GHz f_{MAX} ISOSAT™-1 silicon bipolar process. This process uses nitride self-alignment, submicrometer lithography, trench isolation, ion implantation, gold metallization, and polyimide inter-metal dielectric and scratch protection to achieve excellent performance, uniformity and reliability.

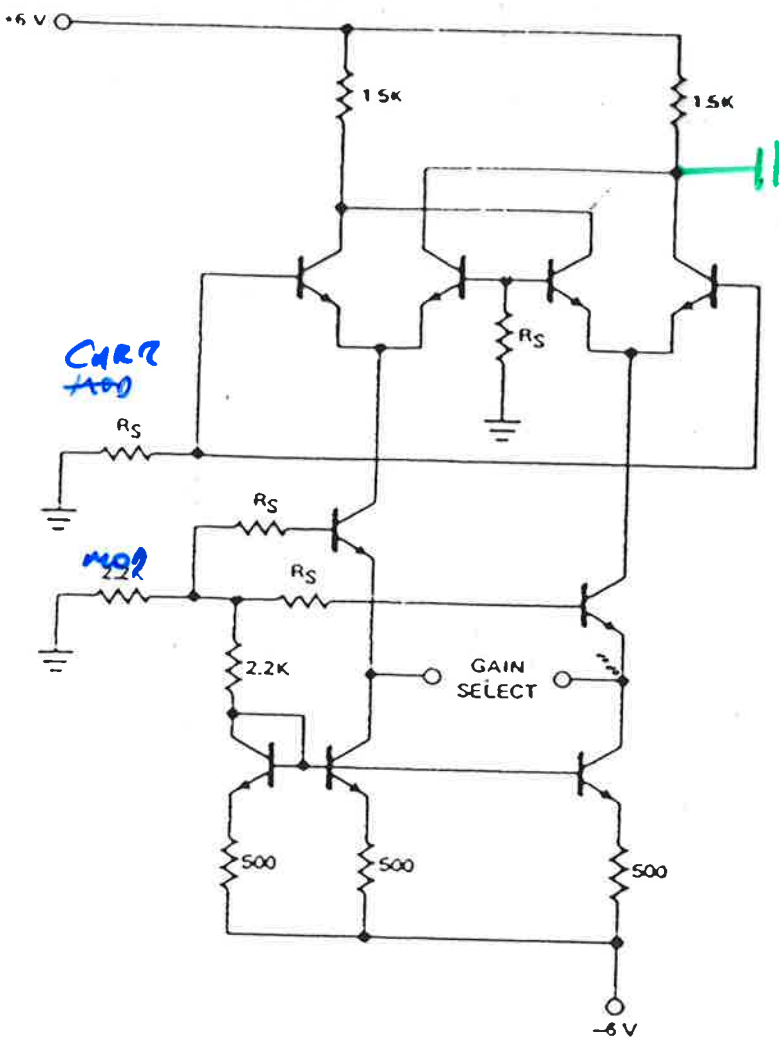
Plastic SO-8 Package



Functional Block Diagram and Pin Configuration



Pin Description	
1 IF Output	8 RF Ground (optional)
2 V_{ee}, AC Ground	7 V_{CC}
3 V_{cc}, AC Ground Thermal Contact	6 LO Ground (optional)
4 RF Input	5 LO Input



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NOTE:
All resistor values are in ohms

Figure 3. Dual Supply Biasing

WATCH OUT FOR PIN #'S BETWEEN DIP AND TO-8 CAN

SIGNETICS AP NOTE AN 189 IS VERY HELPFUL