

# MONOLITHIC BROADBAND AMPLIFIERS DC-10GHz

Model	Typical dB Gain at Frequency GHz										Output Power 1dB Comp@1GHz	Noise Figure @1GHz	OPIP3 dBm
	0.1	0.5	1	2	3	4	6	8	9	10			
MAR-1	17.8	17.5	16.5	12.3	9.3	6.6	-	-	-	-	+2.5dBm ( 0.5GHz )	3.3	+14.0
MAR-2	12.5	12.3	12.0	11.0	-	-	-	-	-	-	+7dBm	3.7	+22.0
MAR-3	12.5	12.2	12.0	10.5	-	-	-	-	-	-	+10.0dBm	3.7	+23.0
MAR-4	8.3	8.2	8.0	6.27	4.74	2.93	-	-	-	-	+12.5dBm	6.0	+25.5
MAR-6	22.0	21.2	20.0	17.0	14.27	12.18	9.08	7.78	6.0	-	+3.0dBm	3.0	+14.5
MAR-7SM	13.5	13.1	12.5	11.0	-	-	-	-	-	-	+5.5dBm	3.5	+19.0
MAR-8SM	32.5	28.0	22.5	15.9	12.17	10.6	4.8	-	-	-	+12.5dBm	3.3	+27.0
MAV-11	12.7	12.0	10.5	7.4	4.6	1.88	-	-	-	-	+17.5dBm	3.9	+30.0
ERA-1	12.3	12.1	12.0	11.8	10.9	9.7	7.9	8.2	-	-	+12.0dBm (2GHz)	4.4 (2GHz)	+28.0
ERA-2	16.4	16.4	15.8	14.9	13.9	12.5	10.7	-	-	-	+13.0dBm (2GHz)	3.3 (2GHz)	+29.0
ERA-3	23.0	22.3	21.0	18.7	16.4	-	-	-	-	-	+12.5dBm (2GHz)	2.8 (2GHz)	+27.5
ERA-4	14.4	14.2	14.0	13.0	12.0	11.3	10.0	-	-	-	+16.2dBm	4.3	+30.0
ERA-5	20.4	20.1	20.0	17.2	15.1	13.4	10.5	8.3	6.6	4.0	+17.1dBm	4.0	+32.0
ERA-6	12.6	12.5	12.5	11.7	11.5	10.3	-	-	-	-	+17.7dBm	4.5	+33.0
GALI-1	12.7	12.6	12.5	11.8	11.3	10.5	10.5	11.0	-	-	+12.2dBm (2GHz)	4.5 (2GHz)	+27.0
GALI-21	14.3	14.0	13.9	13.1	12.4	11.5	11.9	12.4	-	-	+12.6dBm (2GHz)	4.0 (2GHz)	+27.0
GALI-2	16.2	16.0	15.8	14.8	13.7	12.7	13.2	15.1	-	-	+12.9dBm (2GHz)	4.6 (2GHz)	+27.0
GALI-3	22.4	21.5	21.1	19.1	17.3	16.1	15.8	-	-	-	+12.5dBm (2GHz)	3.5 (2GHz)	+25.0
GALI-33	19.3	19.0	18.7	17.5	16.3	15.5	15.8	-	-	-	+13.4dBm (2GHz)	3.9 (2GHz)	+22.9
GALI-39	20.8	21.0	21.1	19.7	17.7	17.0	17.0	-	-	-	+10.5dBm (7GHz)	2.4 (2GHz)	+28.0
GALI-4	14.4	14.2	14.1	13.5	13.0	12.5	13.1	-	-	-	+17.5dBm	4.0	+32.0
GALI-4F	14.3	14.2	14.0	13.4	13.0	12.3	13.2	-	-	-	+15.3dBm	4.0	+34.0
GALI-49	14.0	14.0	13.7	13.6	12.9	12.4	12.0	-	-	-	+15.0dBm	4.4	+33.3
GALI-5	20.6	20.0	19.4	17.5	16.0	14.9	15.1	-	-	-	+18.0dBm	3.5	+31.5
GALI-51	18.1	17.8	17.5	16.1	14.7	13.7	13.4	-	-	-	+18.0dBm	3.5	+35.0
GALI-51F	18.0	17.7	17.3	15.9	14.8	13.4	13.3	-	-	-	+15.9dBm	3.5	+32.0
GALI-52	22.9	22.0	20.8	17.8	15.9	14.4	-	-	-	-	+15.5dBm	2.7	+32.0
GALI-55	21.9	21.2	20.6	18.5	17.0	15.5	15.7	-	-	-	+15.0dBm (2GHz)	3.3 (2GHz)	+28.5
GALI-59	20.6	20.0	19.7	18.3	16.7	15.4	12.0	-	-	-	+17.6dBm (2GHz)	4.3	+33.3
GALI-6	12.2	12.2	12.2	11.8	11.3	11.4	12.3	-	-	-	+18.2dBm	4.5	+35.5
GALI-6F	12.1	12.0	12.0	11.6	11.4	10.9	12.3	-	-	-	+15.8dBm	4.5	+35.5
GALI-S66	22.0	21.0	20.3	17.3	15.5	-	-	-	-	-	+2.8dBm	2.7 (2GHz)	+18.0
GALI-74	25.1	23.5	21.8	18.0	15.3	13.4	-	-	-	-	+18.3dBm	2.7	+33.0
GALI-84	25.6	24.0	22.7	19.2	16.7	15.0	11.8	-	-	-	+21.5dBm	4.4	+37.8
MGA30989	-	-	-	-	12.0	-	9.6	-	-	-	+23.8dBm (5GHz)	1.65 (5GHz)	+38.4
MGA31189	-	21.0	21.0	19.0	-	-	-	-	-	-	+24.4dBm (1.5GHz)	1.8 (1.5GHz)	+41.3
MGA31389	-	21.5	21.4	19.5	-	-	-	-	-	-	+21.7dBm (1.5GHz)	2.0 (1.5GHz)	+41.3
MGA82563	-	14.7	14.5	13.2	12.1	10.7	8.8	-	-	-	+17.3dBm (2GHz)	2.2 (2GHz)	+31.0
MGA86563	-	-	21.0	22.7	22.0	18.0	13.7	-	-	-	+4.1dBm (2GHz)	1.5 (2GHz)	+15.0
MGA86576	-	-	20.0	22.0	23.4	-	19.3	15.4	-	-	+7.0dBm (2.5GHz)	1.8 (6GHz)	+16.0
NLB-300	13.5	13.5	13.0	10.7	10.7	10.7	8.9	8.9	8.9	8.9	+11.1dBm (2GHz)	4.9 (3GHz)	+28.6
NLB-310	12.7	12.7	12.7	12.4	11.7	11.0	10.0	10.0	10.0	8.9	+12.6dBm (2GHz)	5.0 (3GHz)	+28.9
PGA-103	-	26.5	16.2	11.0	8.1	6.2	-	-	-	-	+21.5dBm (0.4GHz)	0.5 (0.4GHz)	+39.0
PHA-1	-	17.2	15.0	13.5	11.8	10.7	9.7	-	-	-	+22.4dBm (2GHz)	2.2 (2GHz)	+42.0

## BIAS CONFIGURATION

## SUGGESTED RESISTOR BIAS VALUES

Model	ImA	Vd	+5Vcc	+9Vcc	+12Vcc	+13.8Vcc	P / Watts Resistor (+12vdc)
MAR-1	17	5.00	-	220ohm	470ohm	560ohm	0.119W
MAR-2	25	5.00	-	150ohm	270ohm	390ohm	0.175W
MAR-3	35	5.00	-	120ohm	200ohm	270ohm	0.245W
MAR-4	50	5.25	-	75ohm	150ohm	180ohm	0.338W
MAR-6	16	3.50	100ohm	390ohm	560ohm	680ohm	0.136W
MAR-7	22	4.00	47ohm	220ohm	390ohm	470ohm	0.176W
MAR-8	36	7.80	-	33ohm	120ohm	180ohm	0.151W
MAV-11	60	5.50	-	56ohm	120ohm	150ohm	0.390W
ERA-1	40	3.60	35ohm	130ohm	220ohm	255ohm	0.336W
ERA-2	40	3.60	35ohm	130ohm	220ohm	255ohm	0.336W
ERA-3	35	3.50	43ohm	157ohm	243ohm	300ohm	0.298W
ERA-4	65	5.00	-	62ohm	109ohm	130ohm	0.462W
ERA-5	65	4.90	-	62ohm	109ohm	130ohm	0.462W
ERA-6	70	5.50	-	50ohm	93ohm	136ohm	0.455W
Gali-1	40	3.40	40ohm	140ohm	220ohm	260ohm	0.344W
Gali-2	40	3.50	37.5ohm	137ohm	215ohm	260ohm	0.344W
Gali-3	35	3.30	47ohm	162ohm	249ohm	300ohm	0.305W
Gali-39	35	3.50	43ohm	157ohm	243ohm	300ohm	0.298W
Gali-4	65	4.60	-	68ohm	110ohm	143ohm	0.480W
Gali-5	65	4.40	-	68ohm	110ohm	143ohm	0.480W
Gail-6	70	5.00	-	56ohm	100ohm	120ohm	0.490W
Gali-84	100	5.80	-	33ohm	62ohm	82ohm	0.620W
MGA30989	51	5.0	0ohm	Self biased for +5vdc operation			0.255W (+5vdc)
MGA31189	110	5.0	0ohm	Self biased for +5vdc operation			0.550W (+5vdc)
MGA31389	73	5.0	0ohm	Self biased for +5vdc operation			0.365W (+5vdc)
MGA82563	84	3.0	0ohm	Self biased for +3vdc operation			0.252W (+3vdc)
MGA86563	14	5.0	0ohm	Self biased for +5vdc operation			0.070W (+5vdc)
MGA86576	16	5.0	0ohm	Self biased for +5vdc operation			0.080W (+5vdc)
NLB-300	50	3.8	22ohm	104ohm	162ohm	200ohm	0.190W
NLB-310	55	4.6	60ohm	80ohm	134ohm	162ohm	0.253W
PGA-103	97	5.0	0ohm	Self biased for +3 to +5vdc operation			0.485W (+5vdc)
PHA-1	146	5.0	0ohm	Self biased for +4.5 to +5vdc operation			0.730W (+5vdc)

**This Data was assembled from data sheets sourced from Avago, Hewlett Packard, Mini-Circuits, and RF Microdevices. It is assumed to be reasonably accurate, & is intended as a quick reference guide for Engineers & Experimenters. For more detailed Data please refer to the Manufacturers WEB sites. This Data may be updated at any time due to changes from Manufactures, or errors. Only products that are commonly used by Ham Radio experimenters or sold by Mini-Kits are listed, as it is not possible to list every device or the different package devices available.**

Many of these Products listed are available in stock from [www.minikits.com.au](http://www.minikits.com.au)

## TYPICAL BIASING CONFIGURATION

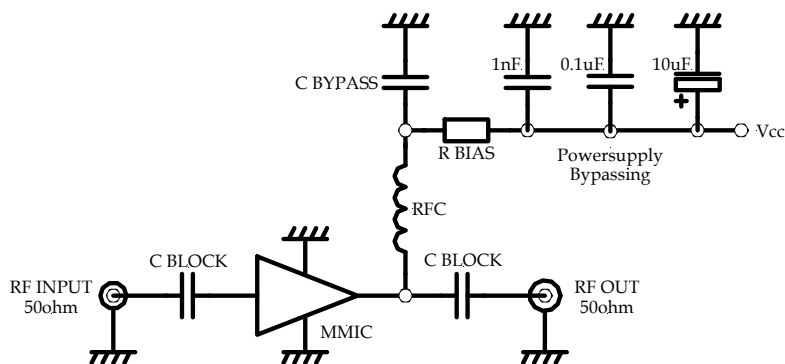
MSA = Monolithic Silicon Amp  
MMIC= Monolithic Microwave  
Integrated Circuit

$$R_{\text{bias}} = \frac{V_{\text{CC}} - V_{\text{d}}}{I_{\text{bias}}}$$

$V_{\text{CC}}$  = The supply Voltage  
 $V_{\text{d}}$  = The Device Voltage  
 $I_{\text{bias}}$  = The Bias Current In mA ( ImA )

$$P_{\text{Watts}} = V \times I$$

$P_{\text{Watts}}$  = Power Rating Of R bias  
 $V$  = Volts across R bias  
 $I$  = Current Through R bias



**C block:** Mainly determines the low frequency response of the amplifier. For frequencies up to 3.4GHz, standard NPO ceramic 0805 SMD types are fine to use for most applications. For frequencies over 5GHz use the smaller 0603 size for less inductance, & ATC ceramic types for low loss to 10GHz. On 10GHz & higher, ¼ wave stripline couplers are commonly used for low loss.

**DC-60MHz ( 0.1uF ) 100MHz ( 1nF ) 400MHz ( 100pF ) 1.2GHz ( 10pF ) 2.4GHz ( 4p7 ) 10GHz ( 1 - 2pF )**

**RFC (Optional):** Is used to isolate the bias resistor so that it does not appear in parallel with the output load of the amplifier, degrading the output match of the amplifier. The impedance of the choke at the lowest frequency of operation of the amplifier plus the value of the bias resistor should be at least 500ohms

**DC to 60MHz ( 100uH to 10uH SMD 1210 Choke )**

**100MHz ( 10uH SMD 1210 choke )**

**400MHz ( 100nH SMD 1008 or 1210 or 3 turns 0.315mm TCW on a FB-43-101 ferrite bead )**

**1.2GHz ( 47uH SMD 1008 or 1210 choke or, 6 turns 0.315mm ECW 3mm dia closewound airspaced )**

**2.4GHz ( 22uH SMD 1008 or 1210 choke ).**

**3.4GHz ( 15nH SMD 0805 choke ).**

**C bypass:** A Capacitor should be used in conjunction with the RFC to present a low impedance path to ground for any signal that manages to get past the RFC. The Capacitor should be connected at the junction of the R bias resistor & the RFC to ground. On 2.4GHz or higher ATC Porcelain Capacitors or similar may be required for effective bypassing.

**DC-60MHz ( 0.1uF )      100MHz ( 1nF )      400MHz ( 100pF )      1.2GHz ( 10pF )      > 2.4GHz 4p7 to 10pF**

**Power supply Bypassing:** Suitable Capacitors should be used on the Vcc rail to effectively bypass low & high frequencies.

**Suggested Values      10uF Tantalum      0.1uF      1nF ( Use all in parallel )**

## SUGGESTED APPLICATIONS

Application	Mini-Circuits Model
High Freq Gain	ERA2 Usable to 6GHz, GALI-33, GALI-39 Usable to 7GHz, MGA86576 Usable to 8GHz ERA1, NLB-300, NLB-310 Usable to 10GHz,
Very Low Noise	GALI-52 / GALI-S66 (2GHz) / PGA-103 (0.1 to 1GHz) MGA30989, MGA86563, MGA86576
Low Noise Amp	MAR6 / MAR8 / MAV11 ( To 1.2GHz ), MGA82563
Medium Noise	ERA3 / ERA5 ( To 2.4GHz ) / PHA-1
High Dynamic range	MAV11 / ERA4 / 5 / MGA30989 / PGA-103 / PHA-1
Stable High Gain	MAR1 / ERA3 / 5 / GALI-39 / GALI-48
Medium Output	ERA4 / ERA5 / ERA6 / GALI-4 / GALI-5 / GALI-6 / MAR3 / MAR4 / MAV11
High Output	GALI-84 / PGA-103 / PHA-1 / MGA30989 / MGA31189 / MGA31389

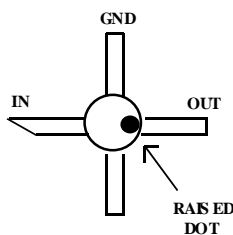
# MONOLITHIC BROADBAND AMPLIFIERS DC-10GHz

## MARKING IDENTIFICATION / EQUIVALENT / CROSS REFERENCE

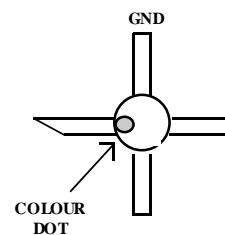
Model Plastic Mini-circuits	Equivalent SMD Mini-Circuits	Equivalent 83mil HP/Avantek	Equivalent Plastic HP/Avantek	Equivalent SMD HP/Avantek	Other Known Equivalents Avantek	Marking Mini-Circuits	Colour Dot
MAR-1	MAR-1SM	MSA-0135	MSA0185	MSA-0186	MSA-0170	A01	Brown
MAR-2	MAR-2SM	MSA-0235	MSA0285	MSA-0286	MSA-0270	A02	Red
MAR-3	MAR-3SM	MSA-0335	MSA0385	MSA-0386	-	A03	Orange
MAR-4	MAR-4SM	-	MSA0485	-	-	A04	Yellow
MAR-6	MAR-6SM	-	MSA0685	MSA-0686	MSA-2111	A06	White
MAR-7	MAR-7SM	MSA-0735	-	MSA-0786	MSA-0711	A07	Violet
MAR-8	MAR-8SM	MSA-0835	MSA0885	MSA-0886	MSA-0870	A08	Blue
MAV-1	MAR-1	-	MSA0104	-	-	1	-
MAV-2	MAR-2	-	MSA0204	-	-	2	-
MAV-3	MAR-3	-	MSA0304	-	-	3	-
MAV-4	MAR-4	-	MSA0404	-	-	4	-
MAV-5	-	-	MSA0504	-	-	5	-
			MSA0604	-	-	6	-
			MSA0704	-	-	7	-
			MSA0804	-	-	8	-
MAV-11	MAV-11SM	-	MSA01104	MSA-1105	-	A	-

Model Plastic Mini-Circuits	Equivalent SMD Mini-Circuits	Possible Equivalent SOT-89 Mini-Circuits	Marking Identification
ERA-1	ERA-1SM	Gali-1	E1 / 01
ERA-2	ERA-2SM	Gali-2	E2 / 02
-	ERA-21SM	Gali-21	21
ERA-3	ERA-3SM	Gali-3	E3 / 03
-	ERA-33SM	Gali-33	33
ERA-4	ERA-4SM	Gali-4	E4 / 04
-	-	Gali-4F	4F
ERA-5	ERA-5SM	Gali-5	E5 / 05
-	-	Gali-5F	5F
-	ERA-50SM	-	50
-	ERA-51SM	Gali-51	51
-	-	Gali-51F	51F
-	-	Gali-52	52
-	-	Gali-55	55
ERA-6	ERA-6SM	Gali-6	E6 / 06
-	-	Gali-6F	6F
-	-	Gali-S66	66
-	-	Gali-84	84
-	ERA-8SM	-	-
-	ERA-9SM	-	-

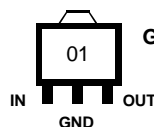
MAV / -04  
( 4-pac Plastic )



MAR / ERA / -85  
( 85mil Plastic )



FRONT VIEW



Gali SOT-89 ( Plastic )

Generally most equivalents listed above can be used, but can have slightly different performance curves due to the different packaging of the devices. The manufacturers Data sheet should always be used to confirm specifications especially when using substitutes. Mini-Circuits types like the RAM / VAM, are different package types of the MAR types. Eg RAM-1 = MAR-1 = MAV-1 = MAR-1SM. Mini-Circuits GAL types have now been renamed Gali. The New Gali types seem to be a low cost SOT- 89 package of the ERA types. Suggested Amplifier Models & Applications show the commonly available packaged devices, & are recommended for general purpose Amateur Radio use.