

MICROWAVE AMPLIFIERS

elisra *electronic
systems ltd.*
Microwave Division



Warranty Elisra warrants products of its manufacture to be free from defects in material and workmanship under conditions of normal use. If within one year after delivery to the original owner and after prepaid return by the original owner, any product is found to be defective, Elisra shall, at its option, repair or replace said defective unit. This warranty does not apply to products which have been disassembled, modified or subjected to conditions exceeding the applicable specifications or ratings. In addition, this warranty does not apply to tubes, transistors, diodes, and fuses. Elisra reserves the right to make design changes without notice on any of its products without any obligation to make the same or similar changes to units previously purchased. In no event does Elisra assume liability for installation, labor or for consequential damages. This warranty is the extent of the obligation or liability assumed by Elisra with respect to its products, and no other warranty or guarantee is either expressed or implied.

Elisra, the Elisra logo are trademarks of Elisra Electronic Systems Ltd. Other company and brand, product and service names are trademarks or registered trademarks of their respective holders. Specifications are subject to change without notice.

Microwave Amplifiers Catalog

T A B L E O F C O N T E N T S

PREFACE

Meet Elisra	4
-------------	---

AMPLIFIERS

General Information	8
---------------------	---

LOW NOISE, SMALL SIGNAL & MEDIUM POWER AMPLIFIERS

Broadband

2-4 GHz	11
2-6GHz	12
4-8GHz	13
6-18GHz	14
8-12GHz	15
8-18GHz	16
2-18GHz	16
0.7-18GHz	17

Narrowband

S to C band	18
C to X band	19
X to Ku band	19

Special Amplifiers

Slope 2-18GHz	20
Pull-Up 2-18GHz	20
Dual Output 2-18GHz	21

Cases & Outline Drawings	22
-------------------------------------	----

Ordering Information	28
-----------------------------	----

POWER AMPLIFIERS

General Information	29
---------------------	----

Series MW30000	29
-----------------------	----

Cases & Outline Drawings	31
-------------------------------------	----

Ordering Information	32
-----------------------------	----

Pulsed	34
---------------	----

TWTA Replacement	35
-------------------------	----

Meet Elisra

Your Source for Quality RF and Microwave Components and Subsystems



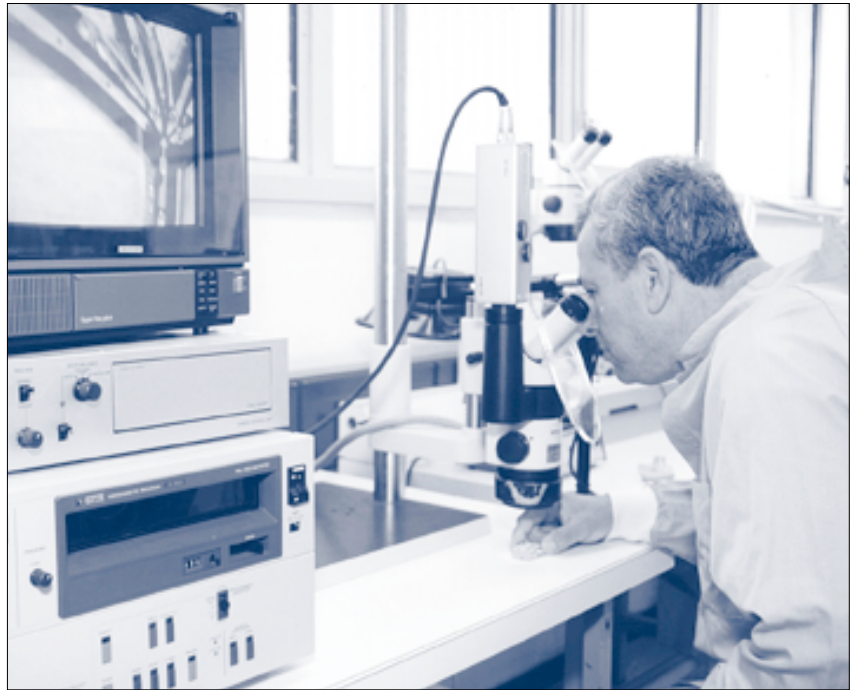
Elisra Electronic Systems is a recognized leader in sophisticated electronic systems and components for defense and civilian markets.

Elisra Microwave Division has over 30 years of proven experience in supplying best-of-class components and subassemblies for a wide variety of

RF and Microwave applications covering the frequency range of 1 MHz to 50 GHz. Modern production facilities operating under a stringent framework of quality assurance standards have established Elisra as a worldclass and preferred supplier of products with unsurpassed reliability.



Our company's highly skilled teams of engineers and technicians, renowned for their technological expertise, have been the cornerstone of our leadership status in both military and commercial markets.



Elisra Defense and Commercial Applications All Across the Globe

Defense applications are known for their demanding and stringent requirements and Elisra systems have been proven with thousands of hours in the field. Based on our wealth-of military expertise, combat know-how and adaptability, we also provide creative and competitive solutions for commercial applications. With more than a \$46 million turnover, our advanced technologies have been brought to all corners of the world. Our growing client list includes such notable companies as Motorola, Lockheed Martin, BAE Systems, Daimler-Benz Aerospace, IBM, British Telecom, Deutsche Telekom, and many others.

Modern Facilities and Experienced Staff

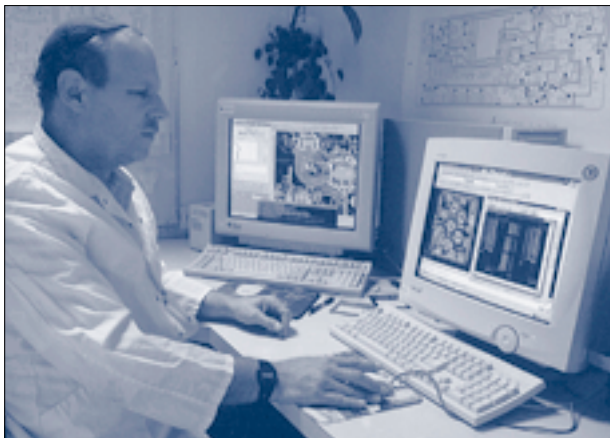
Our modern plant occupies more than 22,000 square meters of floor space and is located in suburb of Tel-Aviv, within close proximity to Ben Gurion International Airport. Over the years, we have built up a team of experienced and committed staff employing a highly skilled group of more than 270 microwave engineers, technicians, production workers and marketing specialists. They support all projects from their inception through to completion with ongoing after-sales support. Our production site also comprises state-of-the-art equipment and facilities including "cleanrooms", laser processing machines, and automatic "pick-and-place" equipment. The majority of the company's engineers and technicians are reserve officers and soldiers in the Israeli Defense Forces, adding unmatched knowledge of the battlefield experience. It is this



very blend of technological expertise and in-depth understanding from real-life scenarios that is the foundation of our position of distinction in the Industry.

Comprehensive Quality Assurance and Reliability Program

Elisra is synonymous and reliability and quality by virtue of the fact that our products are deployed in some of the most innovative and sophisticated military and commercial systems. This is achieved by careful in-house planning and design, accurate workmanship standards, controlled procedures and rigorous inspections. All phases of our activities from design through to production are carefully monitored by the independently managed quality assurance department personnel. Elisra's facilities and products are ISO-9001 certified, reflecting internationally recognized standards. Elisra's quality assurance program is based on the following military specifications and standards: MIL-E-4158, MIL-E-5400, MIL-E-16400, MIL-M-38510, MIL-STD-202, MIL-STD-454.



In-house capabilities at all levels of project design, development, production, testing and system integration assure outstanding accuracy and quick time-to-market.

All systems and components are inspected to conform to precise requirements and specifications.

Comprehensive testing includes simulation of some of the most extreme conditions possible via the use of special vibration, temperature and humidity chambers.

On-Going Customer Support and Satisfaction

The proven reliability of our products is a reflection of the continuous communication we have with our customers.

To ensure that our customers' requirements are met, constant dialogue and feedback are attained at every stage of the development process. Once systems are installed, we provide on-going documentation, training and support to ensure that our clients become expert and successful users of the technology.

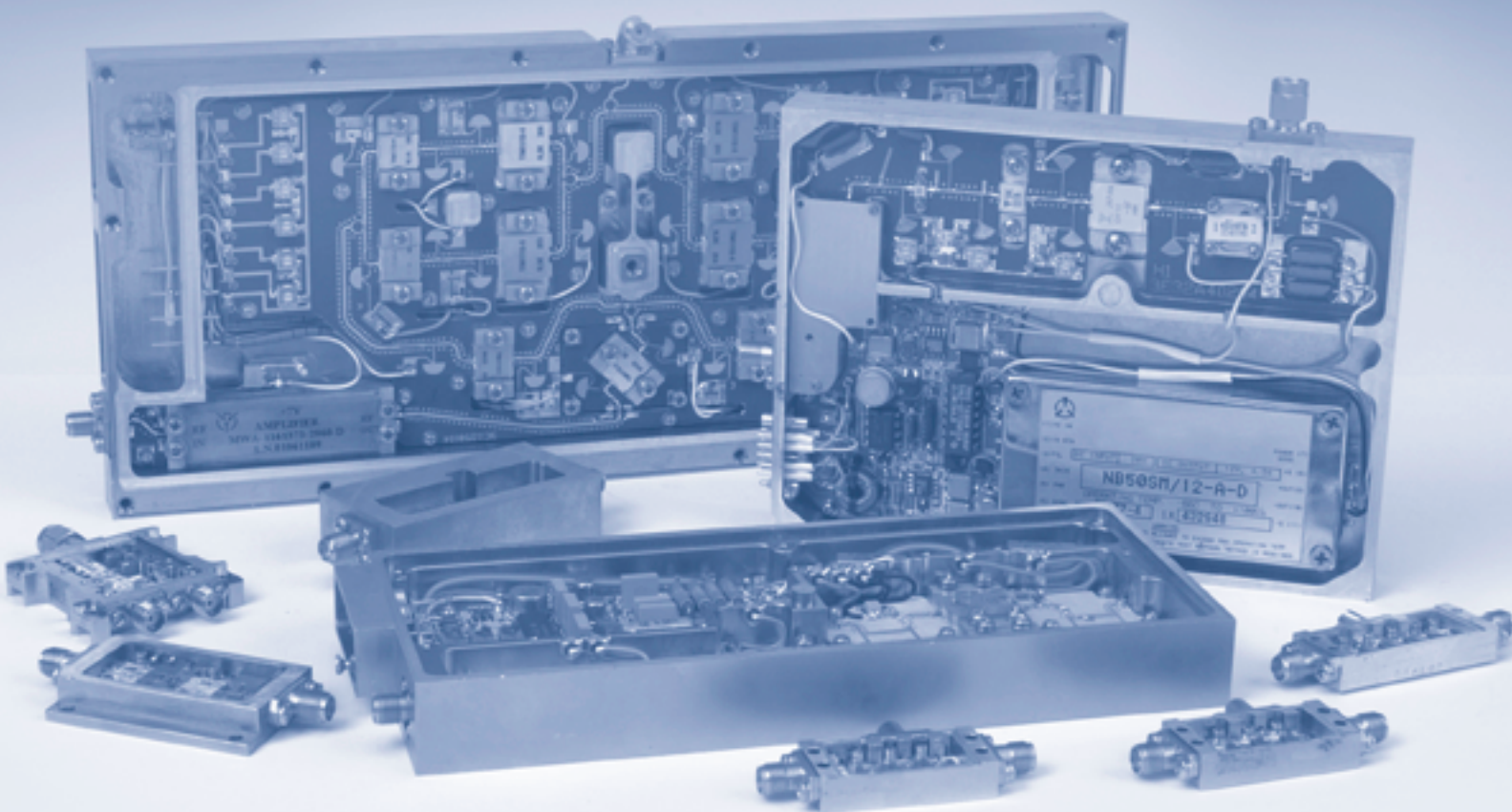
Wide Product Portfolio

In this catalog you will find a brief overview of microwave amplifiers lines offered by Elisra Microwave Division.

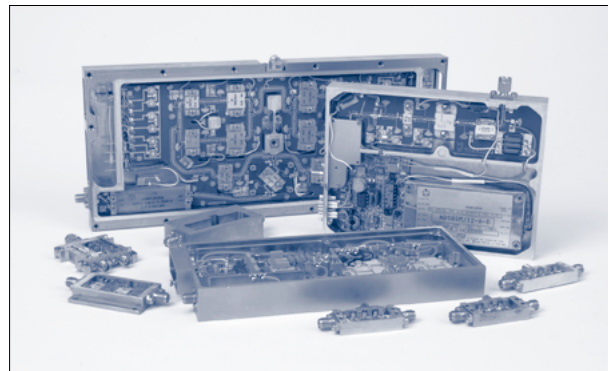
For more details about our other microwave products, please visit our web site:

www.mw-elisra.com

A m p l i f i e r s



Amplifiers



- ▶ **Low Noise, Small Signal & Medium Power Microwave Amplifiers**
- ▶ **Microwave Power Amplifiers**
- ▶ **Pulsed Amplifiers**
- ▶ **TWTA Solid State Retrofit**

GENERAL INFORMATION

Frequency Range

The inclusive band within which the amplifier will meet all its electrical specifications such as gain, noise figure, power output, intermodulation products, and VSWR.

Gain

Gain indicated is the minimum gain across the specified frequency range. This is the small signal gain typically measured 20 dB below the 1 dB compression point.

Typical gains are 3 dB above the minimum values specified.

Gain Flatness

The maximum difference between the minimum and maximum small signal gain across the band at any constant temperature.

Noise Figure

The noise figure of an amplifier is a direct measure of the noise added by the amplifier to the KTB noise presented at the output. The amplifier KTB noise

plus the amplifier noise figure make up the “white” noise power level at the output of the amplifier. This level establishes a lower limit on the dynamic range of the amplifier, specifically the power level at which a signal can be observed above the noise.

Therefore, 1 dB improvement in noise figure corresponded to a 1 dB improvement in the minimum detectable signal and in the dynamic range of the amplifier.

Saturated Output Power

Saturated output power is the maximum output power that the amplifier is capable of generating. This power level is typically constant for input drive levels ranging from a sufficient level to cause hard gain compression to a maximum input power, if specified.

This parameter is typically a specified performance characteristic where maximum output power levels are essential and system linearity is of secondary importance.



RF Burnout

RF burnout is a device failure due to excessive RF overdrive. The input power level which will cause burnout in low noise amplifiers typically varies between 20 and 100 mW. For increased power handling capability, amplifiers can be supplied with RF limiters. However, this feature adds approximately 0.5 to 1 dB to the amplifier noise figure because of limiter insertion loss.

Output Power at 1 dB Compression Point

This is the output power generated by the amplifier when it is driven by an RF level that is sufficient to cause a gain compression of 1 dB from the amplifier's small signal value. The output power level at 1 dB gain compression is typically 3 dB below the saturated output power level. Sometimes referred to as "linear power", this performance characteristic is generally specified when system linearity of wide dynamic range is most important.

Voltage Standing Wave Ratio (VSWR)

A measure of the ratio between the power reflected from one port of the amplifier and the power incident upon it, expressed in VSWR units.

Reverse Isolation

The loss incurred by a signal, incident upon the output of an amplifier as measured at the amplifier input.

Intercept Point for Intermodulation Products

The intermodulation products are defined as the difference (in dB) between the levels of the fundamental signals and the level of the rejected spurious signals.

The intermodulation product characteristics may be calculated from the intermodulation equation. These characteristics may also be obtained either by using the intercept diagram (See Figure 1) or by direct measurement.

Amplifiers are usually characterized by their 2nd and 3rd order intercept points.

The 2nd and 3rd order intercept points are the

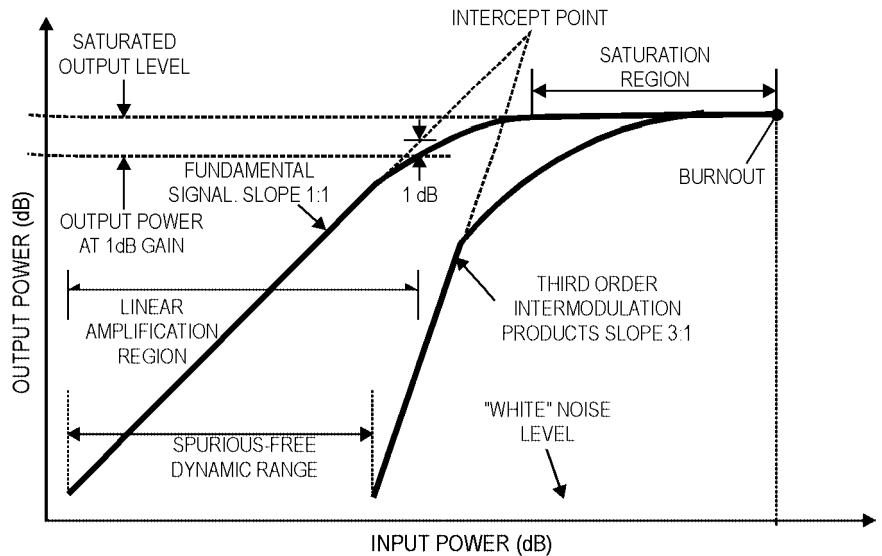


Figure 1.

points where the transfer curves of the 2nd and 3rd order intermodulation products intersect the fundamental signal curve. The slope of the fundamental signals is 1:1 while the slopes of the 2nd and 3rd order products are 2:1 and 3:1, respectively. Therefore, the 2nd order products are as far down from the fundamental as the fundamental is from the intercept point and the 3rd order products are twice as far down. The relationship between the intermodulation products and the intercept points is provided by the following equation:

$$IMP_{(m)} = (m-1) (IP_{(m)} - P_{out})$$

Where

$IMP_{(m)}$ = The m^{th} order intermodulation product

$IP_{(m)}$ = The m^{th} order intermodulation point

P_{out} = The output power of the fundamental signal.

In the small signal case, the level of the 3rd order intermodulation products for two equal input signals may be obtained from the intercept point. This is the point where all orders of harmonically related signals asymptotically intersect (see Figure 2). The output power level of the intermodulation intercept point is typically 10 dB above the output power at the 1 dB gain compression point.

Dynamic Range (DR)

The dynamic range of an amplifier for a single input signal can be defined as the difference between the input signal level that causes a 1 dB gain compression and the minimum detectable signal (MDS), which is defined as 3 dB above the noise level.

$$\text{MDS} = \text{KT} + 10 \log \text{BW} + \text{NF} + 3$$

Where

$$\text{KT} = -114 \text{ dBm}$$

BW = Bandwidth in MHz

NF = Amplifier noise figure in dB

Thus

$$\text{DR} = \text{Pin (at 1 dB)} - \text{MDS}$$

Spurious-Free Dynamic Range (DRS)

Where more than one signal is involved, a spurious free dynamic range (DRS) can be defined as the difference between the input signal level of the intermodulation products and the minimum detectable signal (MDS).

$$\text{DRS}(m) = \frac{(m-1)}{m} (\text{IP}(m) - \text{G} - \text{MDS})$$

where

$\text{DRS}_{(m)}$ = The m^{th} order DRS

$\text{IP}_{(m)}$ = The m^{th} order intercept point

G = The amplifier gain

Power Supply Requirements

For best performance, a solid state amplifier should operate from a regulated DC power source with low ripple content. The ripple from the primary source is harmonically related to the AC line frequency. Thus, for a line frequency of 50Hz, ripple on the DC supply will have components at 50, 100, 200 Hz, etc. This ripple causes certain effects on the RF performance of the amplifier. For applications where well regulated DC is not available, Elisra has standard amplifier models with integral power supplies for operation from the AC line. In situations where DC power is available, but is not regulated, units are supplied with internal regulation.

Device Specifications

The electrical specifications are based on measurement data at room temperature and contain the major parameters needed for system design.

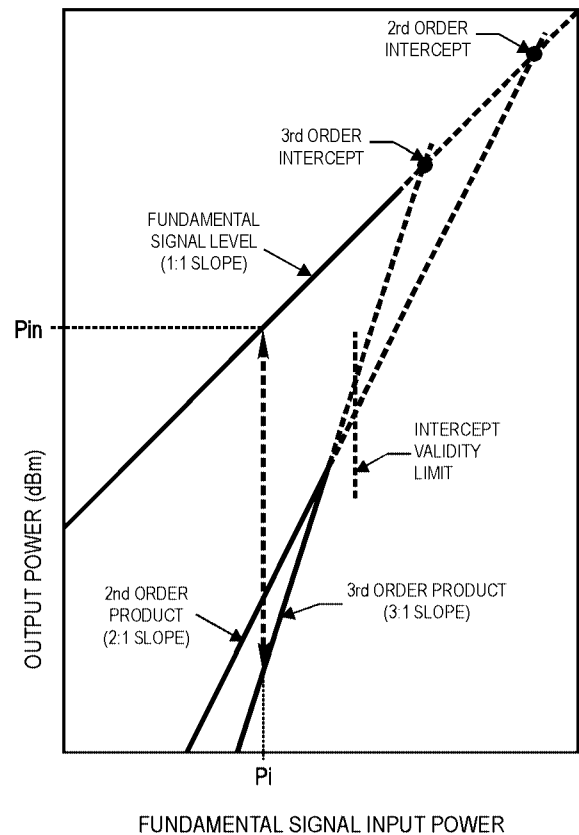
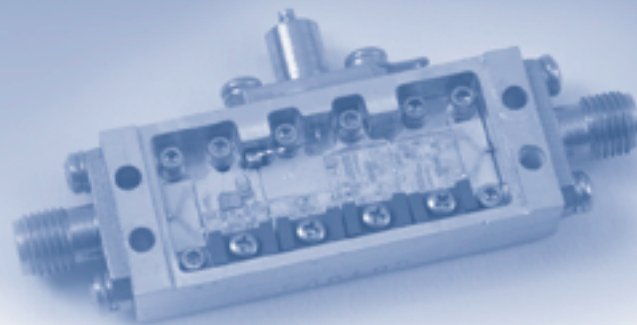


Figure 2. Intercept Diagram

Mechanical Cases and Outline

- ▶ In order to make the selection easy and to shorten the time of delivery this catalog includes a table consisting of the most popular cases in use.
- ▶ Tables of case styles and detailed mechanical dimensions are contained in this catalog.

Low Noise, Small Signal & Medium Power Amplifiers



Broadband

FREQUENCY RANGE: 2-4GHz

Broadband Low Noise Amplifiers

Model	Gain (dB)	Flatness (±dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
	Min.	Max.	Max.	Min.	Typ.	Max.	Nom.
MWA 02040-2220	22	0.75	2.0	+12	+22	2.0:1	+12/100
MWA 02040-3320	33	0.75	2.0	+12	+22	2.0:1	+12/120
MWA 02040-4420	44	1.0	2.0	+12	+22	2.0:1	+12/200

Broadband Amplifiers

MWA 02040-2040	20	1.0	4.0	+15	+25	2.0:1	+12/80
MWA 02040-3040	30	1.0	4.0	+15	+25	2.0:1	+12/140
MWA 02040-4040	40	1.0	4.0	+15	+25	2.0:1	+12/180
MWA 02040-2030	20	1.0	3.0	+15	+25	2.0:1	+12/80
MWA 02040-2030	20	1.0	3.0	+15	+25	2.0:1	+12/80



FREQUENCY RANGE: 2-4GHz

Broadband Medium Power Amplifiers

Model	Gain (dB) Min.	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
MWA02041-2020	20	1.0	6.0	+20	+30	2.0:1	+12/220
MWA 02041-3020	30	1.0	5.5	+20	+30	2.0:1	+12/260
MWA 02041-3825	38	1.5	5.0	+25	+35	2.0:1	+12/560
MWA 02041-4020	40	1.5	5.0	+20	+30	2.0:1	+12/300
MWA 02041-2423	24	1.0	4.0	+23	+33	2.0:1	+12/300
MWA 02041-3425	34	1.5	4.0	+25	+35	2.0:1	+12/500
MWA 02041-3327	33	1.5	4.0	+27	+37	2.0:1	+12/600
MWA 02041-2330	23	1.0	5.0	+22	+32	2.0:1	+12/1300
MWA 02041-2930	29	1.0	4.5	+22	+32	2.0:1	+12/1300
MWA 02041-3530	35	1.0	4.5	+22	+32	2.0:1	+12/1300
MWA 02041-4030	40	1.0	4.5	+22	+32	2.0:1	+12/1300

FREQUENCY RANGE: 2-6GHz

Broadband Low Noise Amplifiers

MWA 02060-2025	20	1.0	2.0	+12	+22	2.0:1	+12/100
MWA 02060-3025	30	1.0	2.0	+12	+22	2.0:1	+12/120
MWA 02060-4025	40	1.0	2.0	+12	+22	2.0:1	+12/200
MWA 02060-3020	30	1.0	2.0	+14	+24	2.0:1	+12/150

Broadband Amplifiers

MWA 02060-2004	20	1.0	4.0	+15	+22	2.0:1	+12/80
MWA 02060-3004	30	1.0	4.0	+15	+22	2.0:1	+12/140
MWA 02060-4004	40	1.0	4.0	+15	+22	2.0:1	+12/200
MWA 02060-2035	20	1.0	3.0	+15	+22	2.0:1	+12/800

Broadband Medium Power Amplifiers

MWA 02061-2020	20	1.0	5.0	+20	+30	2.0:1	+15/220
MWA 02061-3020	30	1.25	5.0	+20	+30	2.0:1	+15/260
MWA 02061-4020	40	1.5	5.0	+20	+30	2.0:1	+15/300
MWA 02061-3023	30	1.25	5.0	+23	+33	2.0:1	+15/300
MWA 02061-3025	30	1.25	6.0	+25	+35	2.0:1	+15/600
MWA 02061-4027	40	1.5	6.0	+27	+37	2.0:1	+15/700
MWA 02061-3530	35	1.5	6.0	+30	+40	2.0:1	+15/1300

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)



FREQUENCY RANGE: 4-8GHz

Broadband Low Noise Amplifiers

Model	Gain (dB)	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
	Min.						
MWA 04080-2020	20	1.0	2.0	+12	+22	2.0:1	+12/100
MWA 04080-3020	30	1.0	2.0	+12	+22	2.0:1	+12/100
MWA 04080-3020	30	1.0	2.0	+12	+22	2.0:1	+12/100
MWA 04080-3020	30	1.0	2.0	+14	+24	2.0:1	+12/100

Broadband Amplifiers

MWA 04080-1840	18	1.5	4.0	+15	+22	2.0:1	+12/80
MWA 04080-1805	18	1.0	5.0	+15	+22	2.0:1	+12/100
MWA 04080-2704	27	1.0	4.0	+15	+22	2.0:1	+12/140
MWA 04080-2705	27	1.0	5.0	+15	+22	2.0:1	+12/150
MWA 04080-3604	36	1.0	4.0	+15	+22	2.0:1	+12/180
MWA 04080-3605	36	1.5	5.0	+15	+22	2.0:1	+12/200
MWA 04080-4404	44	1.5	4.0	+15	+22	2.0:1	+12/220
MWA 04080-4405	44	1.5	5.0	+15	+22	2.0:1	+12/80

Broadband Medium Power Amplifiers

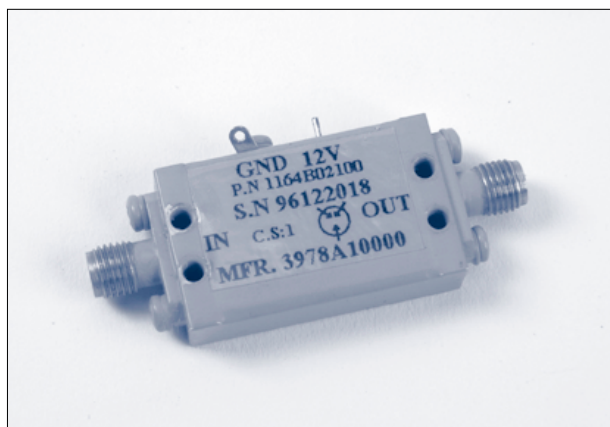
MWA 04081-1720	17	1.0	6.0	+20	+30	2.0:1	+15/220
MWA 04081-2620	26	1.0	6.0	+20	+30	2.0:1	+15/260
MWA 04081-3520	35	1.5	5.0	+20	+30	2.0:1	+15/300
MWA 04081-4320	43	1.5	5.0	+20	+30	2.0:1	+15/360
MWA 04081-1823	18	1.0	6.0	+23	+33	2.0:1	+15/400
MWA 04081-3023	30	1.5	6.0	+23	+33	2.0:1	+15/500
MWA 04081-3030	30	1.5	6.0	+30	+40	2.0:1	+15/1300
MWA 04081-4030	40	1.5	5.0	+30	+40	2.0:1	+15/1400
MWA 04081-3530	35	1.5	5.0	+30	+40	2.0:1	+15/1350

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)



FREQUENCY RANGE: 6-18GHz

Broadband Low Noise Amplifiers



Model	Gain (dB) Min.	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Max.	VSWR (in/out) Max.	DC (V/mA) Nom.
MWA 06180-2735	27	1.25	3.5	+12	+22	2.0:1	+12/180
MWA 06180-3435	34	1.50	3.5	+12	+22	2.0:1	+12/260
MWA 06180-4135	41	1.75	3.5	+12	+22	2.0:1	+12/340
MWA 06180-3035	30	1.5	3.5	+14	+24	2.0:1	+12/250

Broadband Amplifiers

MWA 06180-1550	15	1.0	5.0	+12	+22	2.0:1	+12/150
MWA 06180-2050	20	1.0	5.0	+12	+22	2.0:1	+12/200
MWA 06180-2550	25	1.5	5.0	+12	+22	2.0:1	+12/250
MWA 06180-3050	30	1.5	5.0	+12	+22	2.0:1	+12/300

Broadband Medium Power Amplifiers

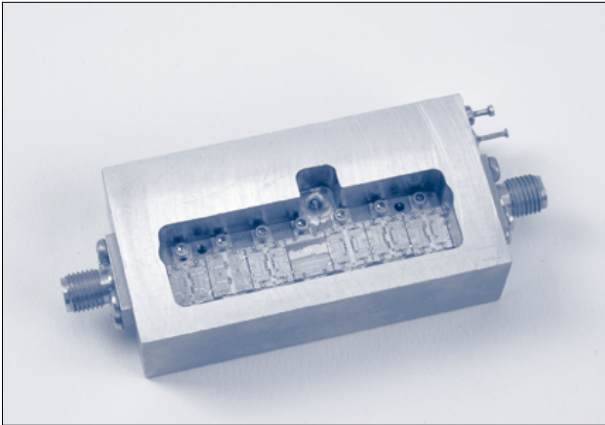
MWA06181-1317	13	1.0	6.5	+17	+27	2.0:1	+12/150
MWA 06181-1320	13	1.0	7.0	+20	+30	2.0:1	+12/200
MWA 06181-1820	18	1.0	7.0	+20	+30	2.0:1	+12/250
MWA 06181-1822	22	1.5	7.0	+22	+32	2.0:1	+12/450
MWA 06181-2624	26	1.5	7.0	+24	+34	2.0:1	+12/650
MWA 06181-2627	26	1.5	8.0	+27	+37	2.0:1	+12/1200
MWA 06181-4029	40	1.5	5.0	+29	+39	2.0:1	+12/1200

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)



FREQUENCY RANGE: 8-12GHz

Broadband Low Noise Amplifiers



Model	Gain (dB) Min.	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
MWA 08120-2030	20	1.25	3.0	+12	+22	2.0:1	+12/150
MWA 08120-3025	30	1.50	2.5	+12	+22	2.0:1	+12/200
MWA 08120-4025	40	1.25	2.5	+15	+25	2.0:1	+12/250

Broadband Amplifiers

MWA 08120-0950	9	1.0	5.0	+15	+22	2.0:1	+12/60
MWA 08120-1850	18	1.0	5.0	+15	+22	2.0:1	+12/120
MWA 08120-2750	27	1.25	5.0	+15	+22	2.0:1	+12/180
MWA 08120-3650	36	1.25	5.0	+15	+22	2.0:1	+12/240

Broadband Medium Power Amplifiers

MWA 08121-1617	16	1.0	5.0	+17	+27	2.0:1	+12/150
MWA 08121-1320	13	1.0	6.0	+20	+30	2.0:1	+12/200
MWA 08121-2220	22	1.0	6.0	+20	+30	2.0:1	+12/270
MWA 08121-2623	26	1.0	6.0	+23	+33	2.0:1	+12/440
MWA 08121-3027	30	1.2	6.0	+27	+37	2.0:1	+15/800
MWA 08121-3030	30	1.5	6.0	+30	+40	2.0:1	+15/1300

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)



FREQUENCY RANGE: 8-18GHz

Broadband Amplifiers

Model	Gain (dB)	Flatness (±dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
	Min.	Max.	Max.	Min.	Typ.	Max.	Nom.
MWA 08180-1550	15	1.0	5.0	+12	+22	2.0:1	+12/150
MWA 08180-2050	20	1.0	5.0	+12	+22	2.0:1	+12/200
MWA 08180-2550	25	1.0	5.0	+12	+22	2.0:1	+12/250

FREQUENCY RANGE: 12-18GHz

Broadband Amplifiers

Model	Gain (dB)	Flatness (±dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
	Min.	Max.	Max.	Min.	Max.	Max.	Nom.
MWA 12180-1650	16	1.0	5.0	+12	+22	2.0:1	+12/150
MWA 12180-2150	21	1.0	5.0	+12	+22	2.0:1	+12/200
MWA 12180-2750	27	1.5	5.0	+12	+22	2.0:1	+12/250
MWA 12180-3250	32	1.5	5.0	+12	+22	2.0:1	+12/300

Broadband Medium Power Amplifiers

MWA 12181-1317	13	1.0	6.5	+17	+27	2.0:1	+12/150
MWA 12181-1320	13	1.0	7.0	+20	+30	2.0:1	+12/200
MWA 12181-1820	18	1.0	7.0	+20	+30	2.0:1	+12/250
MWA 12181-2322	23	1.0	7.0	+22	+32	2.0:1	+12/450
MWA 12181-2724	27	1.5	7.0	+24	+34	2.0:1	+12/650
MWA 12181-2727	27	1.5	7.5	+27	+37	2.0:1	+12/1100

1. Parameters are guaranteed at +25°C (case temperature)
2. Case outline drawing (see page 1-22)



FREQUENCY RANGE: 2-18GHz

Broadband Low Noise Amplifiers

Model	Gain (dB)	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
	Min.						
MWA 02180-2340	26	1.5	4.5	+12	+22	2.0:1	+12/140
MWA 02180-3040	26	1.5	4.5	+12	+22	2.0:1	+12/200
MWA 02180-2840	26	1.5	4.5	+12	+22	2.0:1	+12/240
MWA 02180-3045	30	1.5	4.5	+12	+22	2.0:1	+12/250
MWA 02180-2650	26	2.5	5.0	+12	+22	2.0:1	+12/250

Broadband Medium Power Amplifiers

MWA 02181-3012	26	1.5	4.5	+12	+22	2.0:1	+12/200
MWA 02181-3018	30	2.0	5.0	+18	+27	2.0:1	+12/300

FREQUENCY RANGE: 0.7-18GHz

Broadband Low Noise Amplifiers

Model	Gain (dB)	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
	Min.						
MWA 07180-1260	12	2.0	6.0	+12	+25	2.0:1	+12/125

FREQUENCY RANGE: 0.5-18GHz

Broadband Low Noise Amplifiers

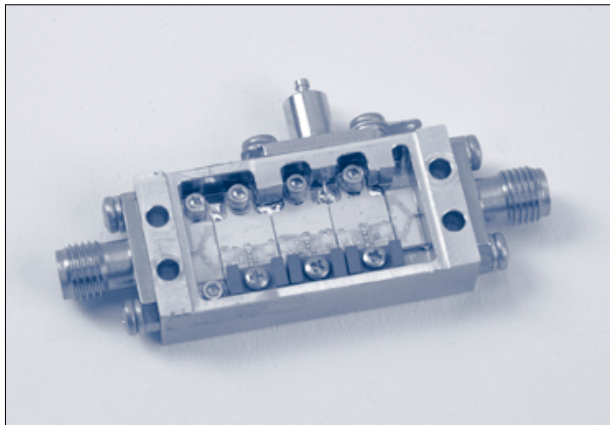
Model	Gain (dB)	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
	Min.						
MWA 05180-860	8.5	2.0	6.0	17.5	27	2.0:1	12/220

1. Parameters are guaranteed at +25°C (case temperature)
2. Case outline drawing (see page 1-22)

Narrowband Amplifiers

FREQUENCY RANGE: S-C BAND

Narrowband Low Noise Amplifiers



Model	Frequency Range (GHz)	Gain (dB) Min.	Flatness (±dB) Max.	NF (dB) Max.	P1db (dBm) Min.	IP3 (dBm) Typ.	VSWR (in/out) Max.	DC (V/mA) Nom.
MWA 37430-2515	3.7-4.3	25	1.0	1.5	+10	+23	2.0:1	+12/100
MWA 44500-2040	4.4-5.0	20	1.0	1.5	+13	+23	2.0:1	+12/100
MWA 47530-2040	4.7-5.3	20	1.0	1.5	+13	+23	2.0:1	+12/100
MWA 54590-2015	5.4-5.9	20	1.0	1.5	+13	+23	2.0:1	+12/100
MWA 59640-2015	5.9-6.4	20	1.0	1.5	+13	+23	2.0:1	+12/100

Narrowband Medium Power Amplifiers

MWA 37421-3542	3.7-4.2	35	1.0	8	30	38	2:1	+12/700
----------------	---------	----	-----	---	----	----	-----	---------

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)



FREQUENCY RANGE: C-X BAND

Narrowband Low Noise Amplifiers

Model	Frequency Range (GHz)	Gain (dB)	Flatness (± dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
		Min.	Max.	Max.	Min.	Typ.	Max.	Nom.
MWA 79840-2015	7.9-8.4	20	1.0	1.5	+15	+23	2.0:1	+12/150
MWA 85960-2015	8.5-9.6	20	1.0	1.5	+15	+23	2.0:1	+12/150
MWA 1091170-2020	10.9-11.7	20	1.0	1.5	+15	+23	2.0:1	+12/150
MWA 1101300-2030	11.0-13.0	20	1.0	3.0	+10	+20	2.0:1	+12/100
MWA 1101300-1730	11.0-13.0	17	1.0	3.0	+10	+20	2.0:1	+12/100

Narrowband Medium Power Amplifiers

MWA 71771-3530	7.1-7.7	35	1.0	8	+30	40	2:1	+12/700
----------------	---------	----	-----	---	-----	----	-----	---------

FREQUENCY RANGE: X-Ku BAND

Narrowband Low Noise Amplifiers

Model	Frequency Range (GHz)	Gain (dB)	Flatness (± dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
		Min.	Max.	Max.	Min.	Typ.	Max.	Nom.
MWA 1101300-1730	11.0-13.0	17	1.0	3.0	+10	+20	2.0:1	+12/100
MWA 1101300-1630	12.7-13.3	17	1.0	3.0	+10	+20	2.0:1	+12/100
MWA 1331400-1630	13.3-14.0	20	1.0	3.0	+10	+20	2.0:1	+12/100
MWA 1401450-1630	14.0-14.5	1.0		3.0	+10	+20	2.0:1	+12/100
MWA 1441540-1530	14.4-15.4	15	1.0	3.0	+8	+20	2.0:1	+12/100
MWA 1571700-1530	15.7-17.0	15	1.0	3.0	+8	+20	2.0:1	+12/100

Narrowband Medium Power Amplifiers

MWA 971071-3030	9.7-10.7	+30	1.0	8	+30			+12/800
MWA 971071-3030	14.0-14.5	+30	1.0	8	+30	40		+12/800

- Parameters are guaranteed at +25°C (case temperature)
- Case outline drawing (see page 1-22)

Special Amplifiers

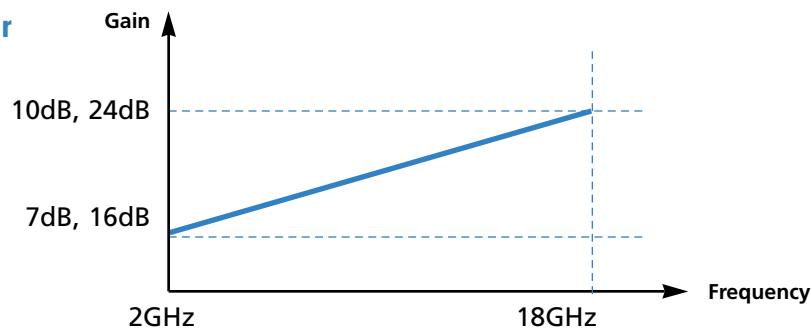
SLOPE AMPLIFIERS: 2-18GHz

Broadband Slope Amplifiers

Typical performance

Gain@2GHz (dB)	Gain@18GHz (dB)	Slope (dB)	Noise Figure (dB)
7	10	3	5.0
16	24	8	5.0

A 10dB Amplifier



Notes:

- 1.All devices are temperature compensated.
- 2.Slope available from 2dB to 8dB @ 30db gain

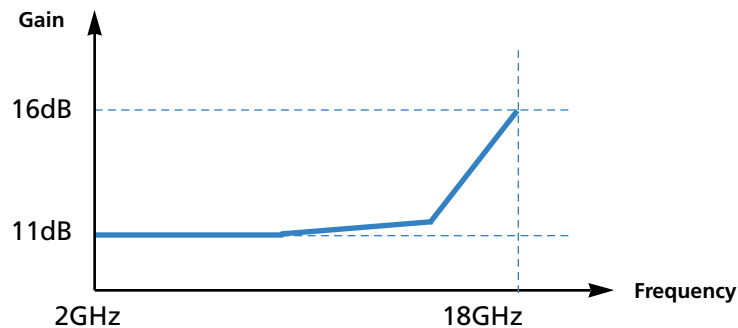
PULL-UP AMPLIFIERS: 2-18GHz

Broadband Pull-Up Amplifiers

Typical performance

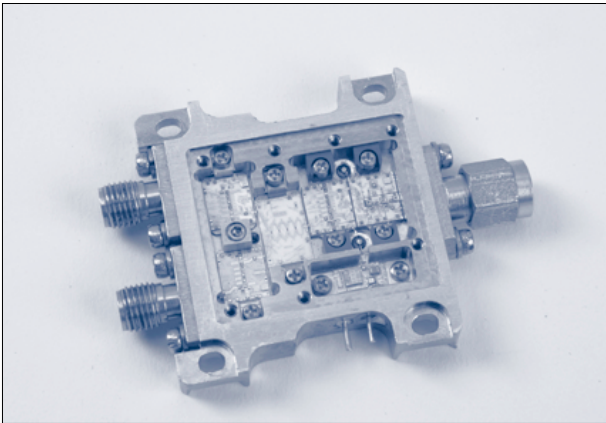
Gain@2GHz (dB)	Gain@16GHz (dB)	Gain@18GHz (dB)	Noise Figure (dB)
11	12	16	6.0
22	24	32	6.0

A 12dB Amplifier



DUAL OUTPUT AMPLIFIERS: 2-18GHz

Broadband Dual Output Amplifiers



Model	Gain (dB)	Flatness (+-dB)	NF (dB)	P1db (dBm)	IP3 (dBm)	VSWR (in/out)	DC (V/mA)
	Min.	Max.	Max.	Min.	Min.	Max.	Nom.
MWA 02180-2175	21	1.5	7.5	+13	+19	2.50:1	+12/420

Options

Phase & Gain, Matching or Tracking upon client's requirements

Cases & Outline Drawings

CASES SELECTION GUIDE*

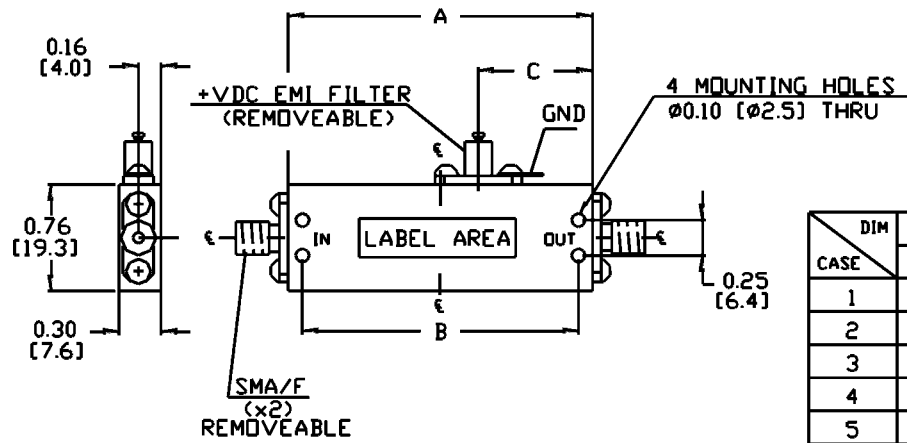
THE MOST POPULAR CASES

Frequency Range	DL	DH	DH-SY	EX	Y
2-4GHz					
2-6GHz					
4-8GHz					
6-18GHz					
8-12GHz					
8-18GHz					
12-18GHz					
2-18GHz					
0.7-18GHz					

* Custom Design cases available upon request.

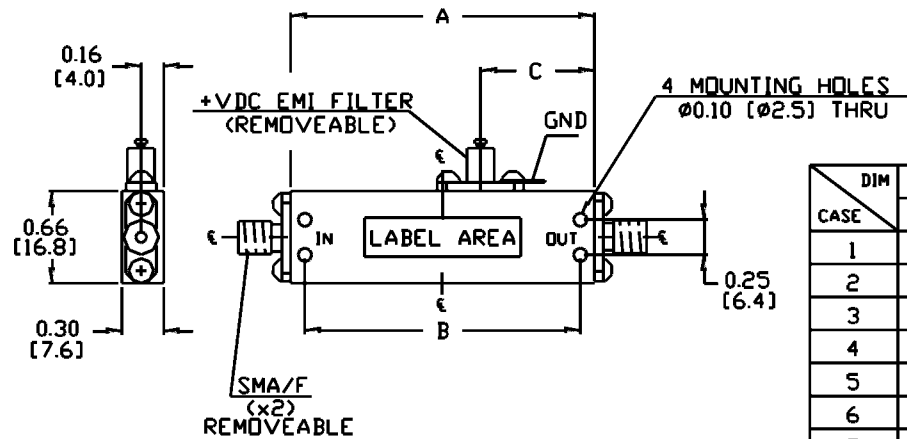


DL-1 TO DL-6



CASE \ DIM	A		B		C	
	inch	mm	inch	mm	inch	mm
1	0.96	24.4	0.82	20.9	0.48	12.2
2	1.26	32.0	1.12	28.5	0.48	12.2
3	1.56	39.6	1.42	36.1	0.78	19.8
4	1.86	47.2	1.72	43.7	0.78	19.8
5	2.16	54.9	2.02	51.3	1.08	27.4
6	2.46	62.5	2.32	59.0	1.08	27.4

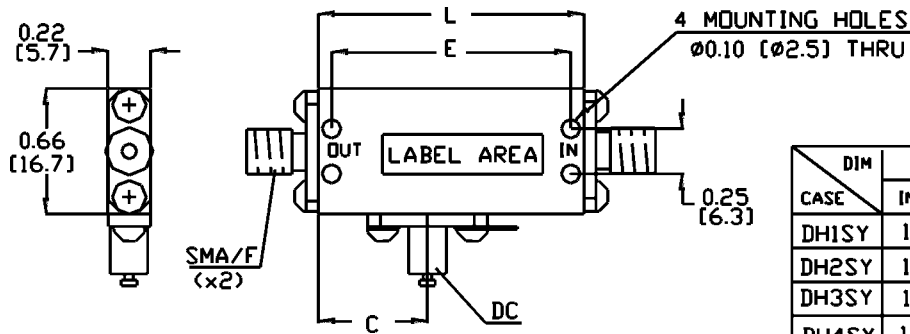
DH-1 TO DH-8



CASE \ DIM	A		B		C	
	inch	mm	inch	mm	inch	mm
1	1.11	28.1	0.97	24.7	0.55	14.0
2	1.36	34.5	1.22	31.0	0.55	14.0
3	1.61	40.8	1.47	37.3	0.80	20.3
4	1.86	47.2	1.72	43.7	0.80	20.3
5	2.11	53.5	1.97	50.0	1.05	26.7
6	2.36	59.9	2.22	56.4	1.05	26.7
7	2.61	66.2	2.47	62.7	1.30	33.0
8	2.86	72.6	2.72	69.1	1.30	33.0

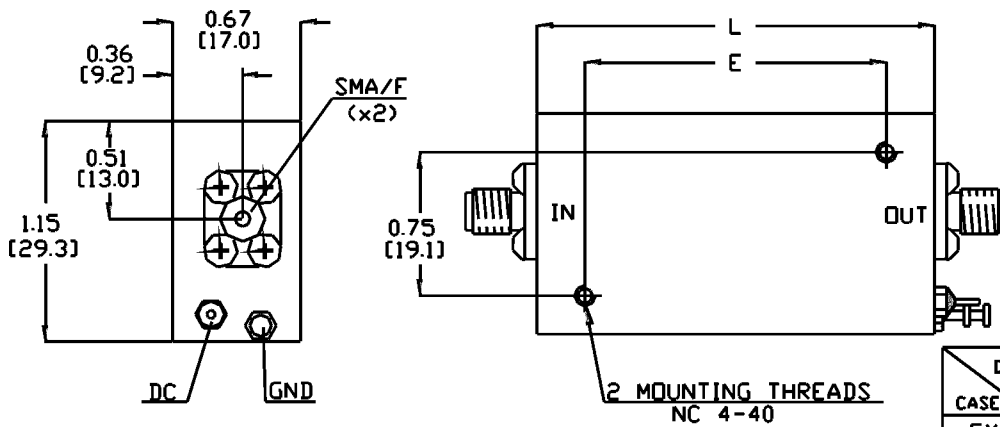


DH1SY TO DH7SY



DIM CASE	L		E		C	
	INCH	MM	INCH	MM	INCH	MM
DH1SY	1.11	28.2	0.97	24.7	0.55	14.0
DH2SY	1.36	34.5	1.22	31.0	0.55	14.0
DH3SY	1.61	40.8	1.47	37.3	0.80	20.3
DH4SY	1.86	47.2	1.72	43.7	0.80	20.3
DH5SY	2.11	53.6	1.97	50.1	1.05	26.7
DH6SY	2.36	60.0	2.22	56.5	1.05	26.7
DH7SY	2.61	66.3	2.47	62.8	1.30	33.0

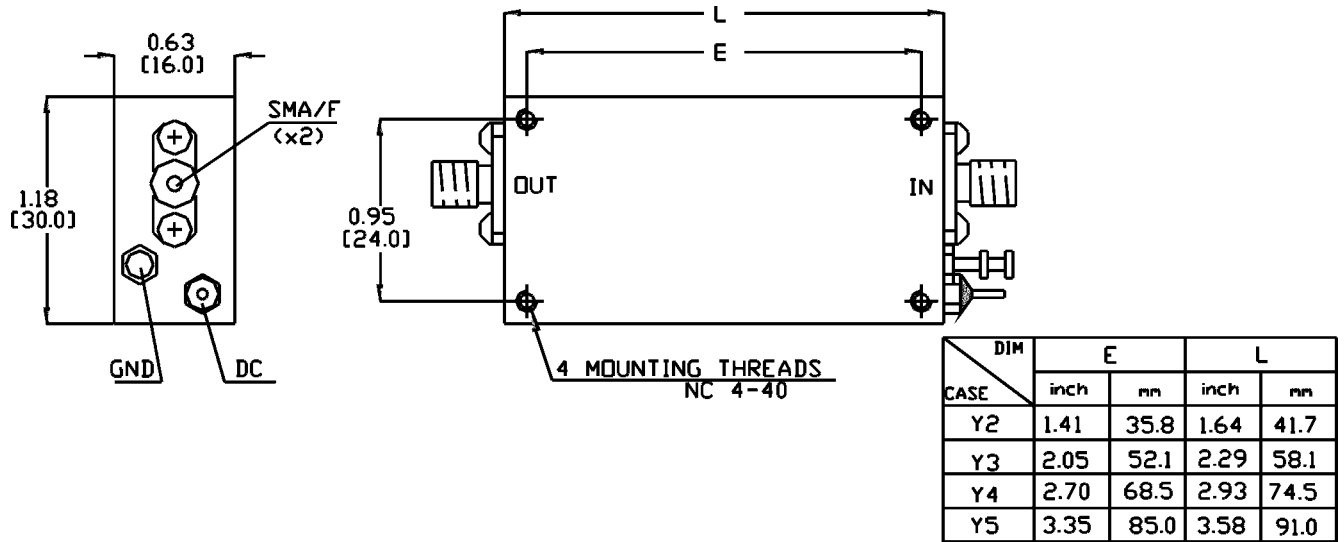
EX-2 TO EX-8



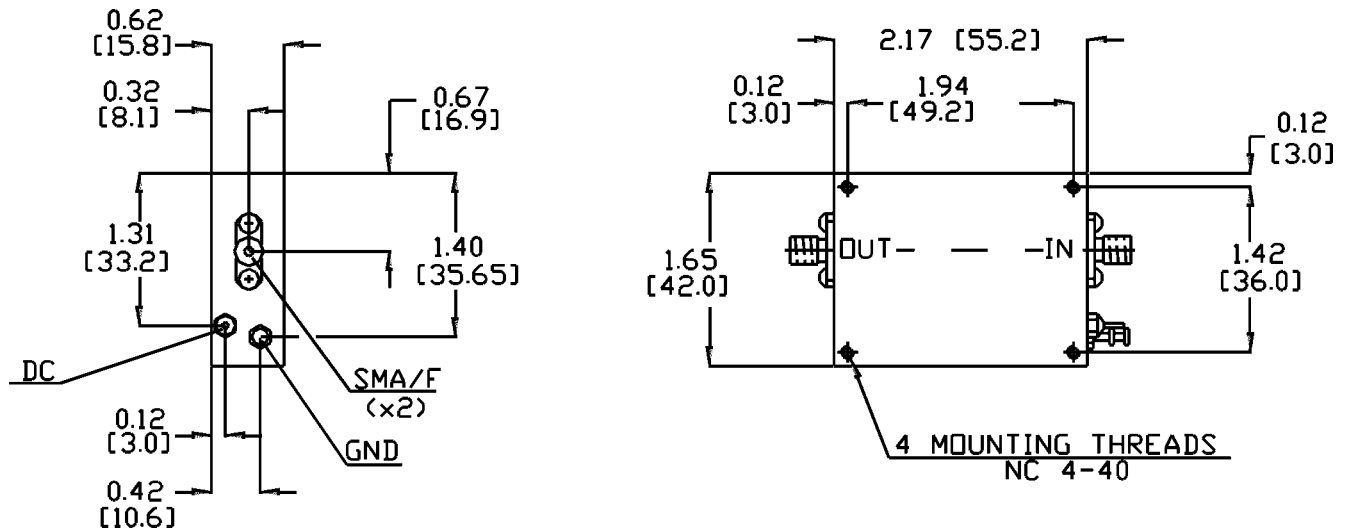
DIM CASE	E		L	
	inch	mm	inch	mm
EX2	0.75	19.1	1.25	31.8
EX4	1.25	31.8	1.75	44.5
EX6	1.75	44.5	2.25	57.2
EX8	2.25	57.2	2.75	69.9



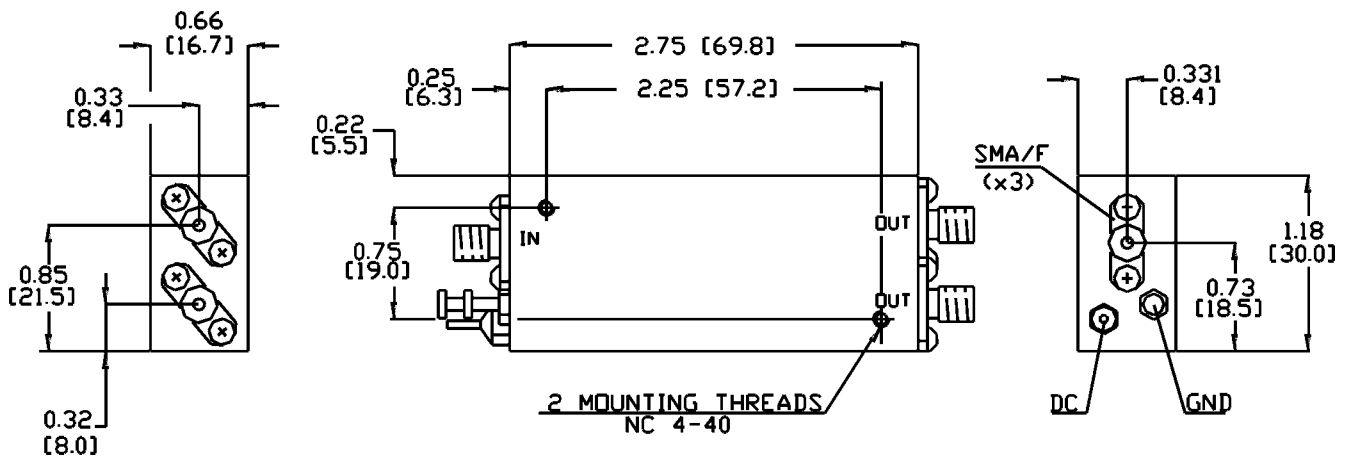
Y-1 TO Y-5



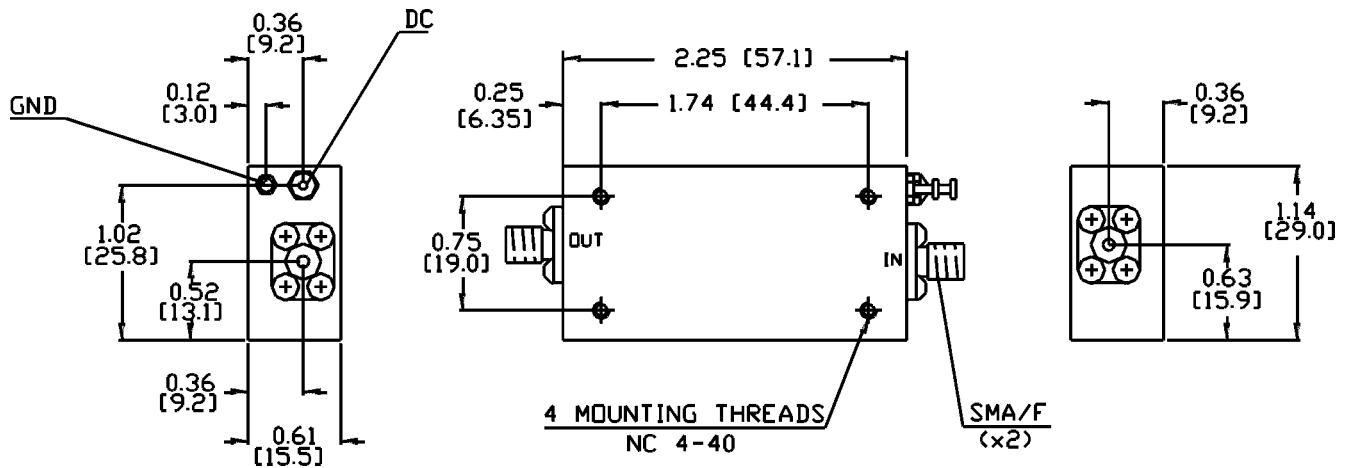
YS-2



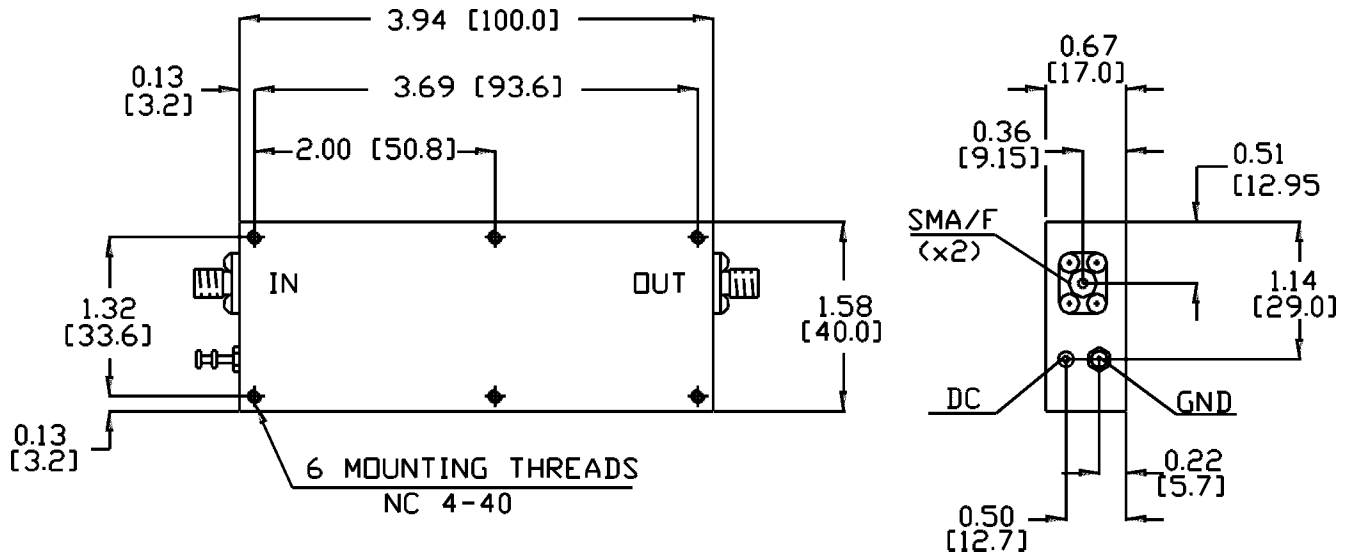
DUAL OUTPUT



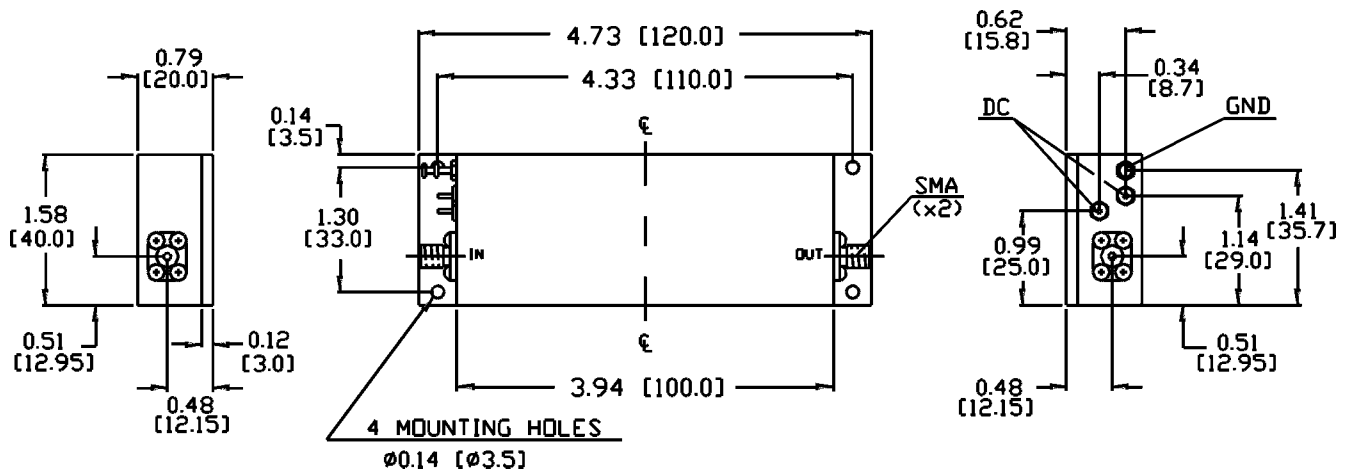
EX-6S



HPX-6

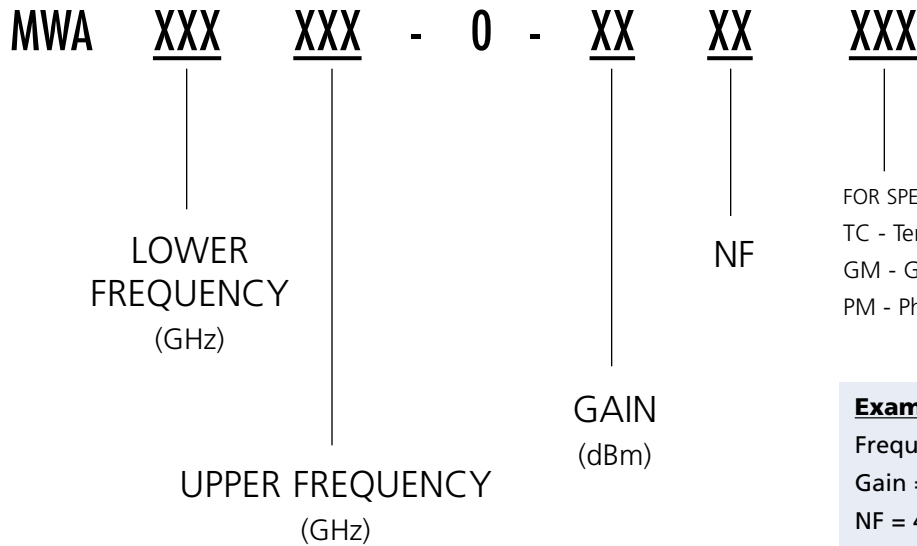


P-2



Ordering Information

LOW NOISE & SMALL SIGNAL AMPLIFIERS



FOR SPECIAL USE:

TC - Temperature Compensation

GM - Gain Matching

PM - Phase Matching

Example:

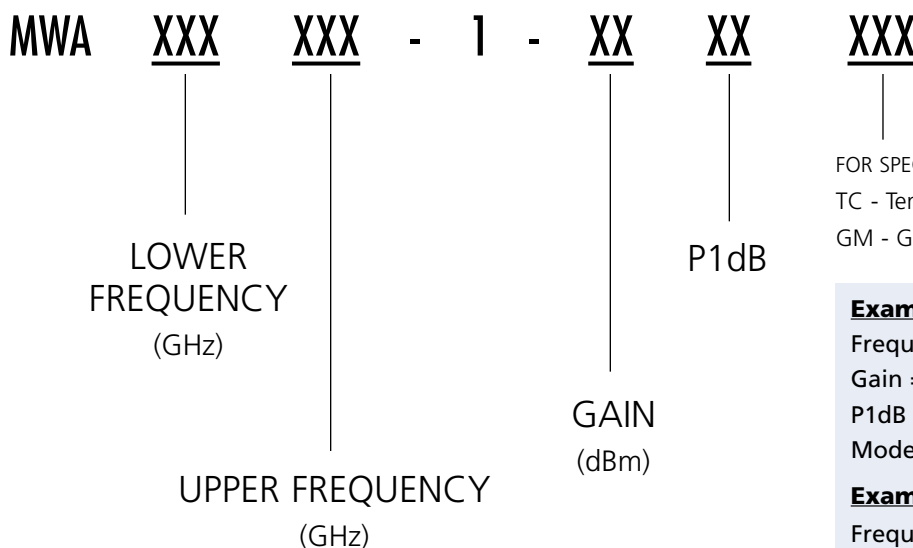
Frequency band = 6.5GHz to 18.0GHz

Gain = 35dB

NF = 4.5dB

Model Part Number: MWA065180-0-3545

MEDIUM POWER AMPLIFIERS



FOR SPECIAL USE:

TC - Temperature Compensation

GM - Gain Matching

Example 1:

Frequency band = 0.4GHz to 1.2GHz,

Gain = 35dB

P1dB = 24dBm

Model Part Number: MWA004012-1-3524

Example 2:

Frequency band = 10.5GHz to 10.8GHz

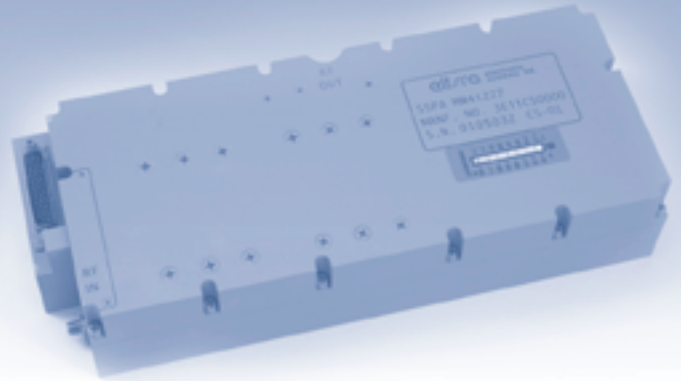
Gain = 15dB

P1dB = 27dBm

Model Part Number: MWA105108-1-1527

1. Parameters are guaranteed at +25°C (case temperature)
2. Case outline drawing (see page 1-22)

Power Amplifiers



Series MW30000 GaAs FET

- ▶ **High Power, High Efficiency**
- ▶ **Wide Operational Temperature Range**
- ▶ **High Reliable MIC Technology**
- ▶ **Internally Built-In Protections: Over Voltage, Reverse Polarity, Supply Sequencing, Load Mismatch**
- ▶ **Hermetically Sealed, RFI Protected Case**

GENERAL INFORMATION

The MW 30000 GaAs FET Power Amplifier series offers a variety of gain and power options, covering the frequency range from 1.5 GHz to 15 GHz.

Many extra options are available, including extended temperature range, temperature compensation, an input/output isolator, RF sampling with or without power detectors, efficient TTL controlled shut-down and more.

Custom designed amplifiers are available upon request. A typical optional amplifier block diagram is depicted in Figure 1, where topology and other optional changes may be made according to customer's specific requirements.

DC Requirements

The standard DC supply requirements are as follows:

Positive Voltage Supply: +12 to +15 Volt at I+ where I+ can be approximately calculated by using the following equation:

$$I+ = 0.7 \times P_o + 0.03 \times G \text{ [Ampere]}$$

where:

P_o = Output power at 1 dB gain compression point in Watts.

G = Linear gain in dB

For example, a power amplifier delivering 10 Watts CW at 1 dB compression point with a 30 dB linear gain will consume about 7.9 Amperes from the positive +12 to +15V power supply using the above mentioned equation.



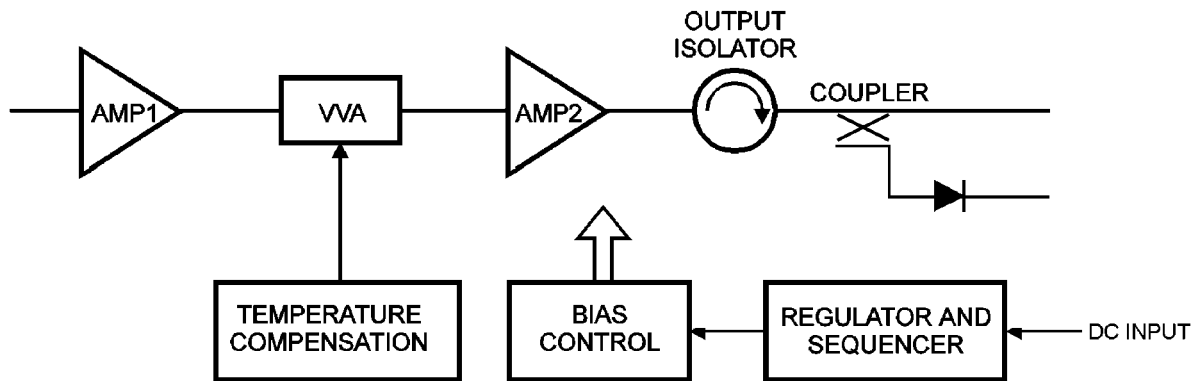


Figure 1. Amplifier Block Diagram

Negative Voltage Supply: -12 to -15 Volt at 100 mA max (200 mA for 25 W models). All amplifiers of this series include an internally built-in voltage regulator.

To ensure a full temperature range and prolonged and stable operation without performance degradations, active bias is used for each FET.

A DC supply card includes all above mentioned protections and other devices according to customer demands.

Cases

Series 30000 utilizes a plated aluminum case with a near perfect surface and heat sink.

A special heat sink technology is used to obtain low junction temperatures at full power, ensuring high reliability and long service life.

SMA connectors are standard for RF input/output. DC and control are fed through RFI protected solder pins.

The case is hermetically sealed.

The dimensions of available standard cases are shown in various case outline drawing. Case dimensions may be dictated by design.

Special cases are available upon request.

GENERAL SPECIFICATIONS

The following specifications are typically common to all models of this series:

Base Plate Operating Temperature Range	-10°C to +60° (-55°C to +95°C available)
Gain Flatness	±1 dB
Gain Stability	±2 dB
Input VSWR	2.0:1 max
Output VSWR	3.0:1 max
Load VSWR	1:1 Nominal, infinity protected
Noise Figure	10 dB max

Environmental Requirements:
MIL-E-5400, Class 2, compatible

OPTIONS

- Base Plate extended operating temperature -55°C to +105°C
- Gain temperature compensation
- RF sample
- DC sample
- Lower than ±1 ns Group Delay variation
- Specified third order intercept point (as high as 9 dB above 1 dB CP)
- Pulsed amplifier utilizing TTL controlled gate enabling
- TTL controlled DC shut down
- Dual matched outputs (gain, power, phase)
- Broad band designs are available

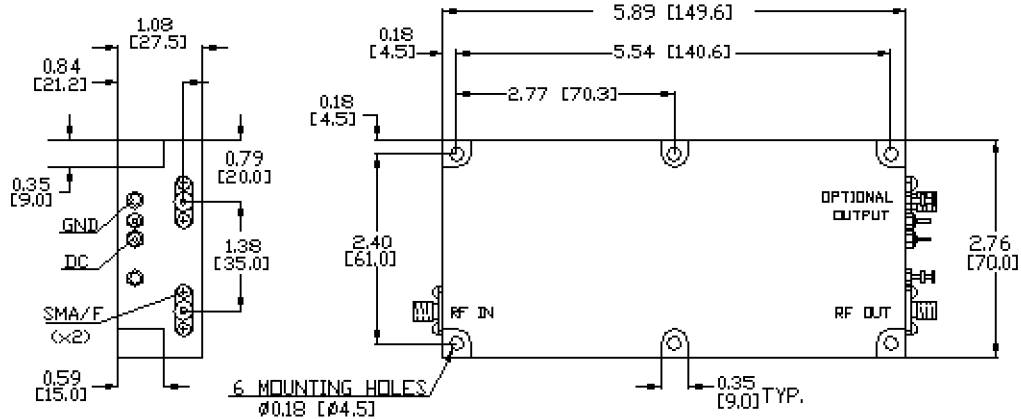
Cases & Outline Drawings

Two standard cases are available. Case A is suitable for amplifiers with typical linear gain of 25 dB, and case B is suitable for higher gains of up to 50 dB according to customer requirements.

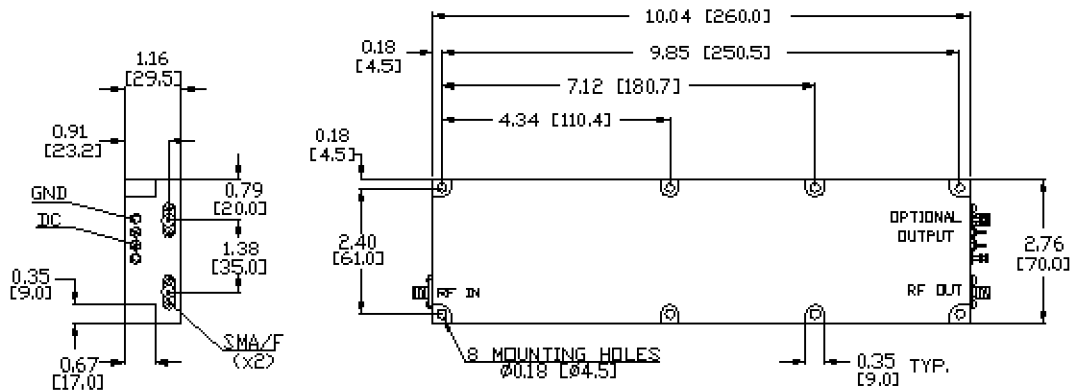
All dimensions are in inches and (mm).

Drawings are in first angle projection.

CASE A - POWER AMPLIFIER



CASE B - POWER AMPLIFIER



Ordering Information

HOW TO ORDER:

Please specify the model number following the example below:

$$\frac{\text{MW34321}}{1} - \frac{9.5}{2} - \frac{10.5}{3} - \frac{0.5}{4} - \frac{20}{5}$$

This example presents the model number for an amplifier with a frequency band from 9.5 to 10.5 GHz, 0.5W output power, and a gain of 20 dB.

Legend

- 1 – Basic Model Number (see Table 1)
- 2 – Lowest Frequency F_L (in GHz)
- 3 – Highest Frequency F_H (in GHz)
- 4 – Output Power (W)
- 5 – Gain (in dB)

TABLE 1.

BASIC MODEL NUMBER CODE

Code	1st Digit Power Amplifier	2nd Digit Center Frequency (GHz)	3rd Digit Output Power (W)	4th Digit Gain (dB)	5th Digit Band-width Ratio (%)*
1	1st Digit Must Be 3	1 - 2	0.1	1 – 10	1 – 10
2		2 - 4	0.3	11 – 20	11 – 20
3		4 - 8	0.5	21 - 30	21 – 31
4		8 – 12.4	1	31 – 40	31 – 40
5		12.4 - 18	3	41 - 50	41 – 50
6			5		51 - 60
7			10		
8			30		
9			50		

*Use the following formula:

$$\text{BWR} = 2(F_H - F_L) / (F_H + F_L)$$

Where

BWR = Bandwidth ration (%)

FH = Highest frequency (GHz)

FL = Lowest frequency (GHz)



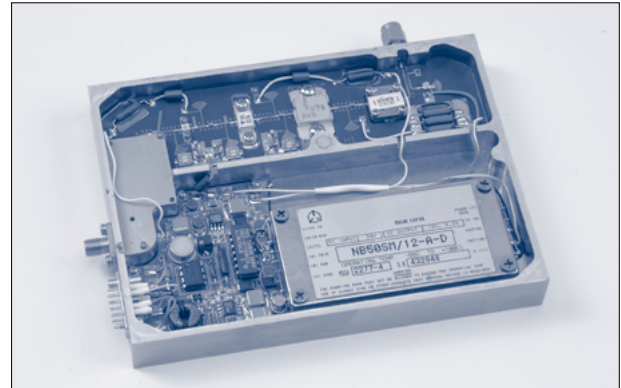
SOME SAMPLES:

Model Number	Frequency (GHz)	Power Output at 1 dB GCP (dBm)	Gain (dB)	Power Output at Saturation (dBm)	Current (A)
32811-3.7-4.2-25.0-10	3.7 – 4.2	44.0	10	45.0	14.4
32811-4.4-5.0-25-10	4.4 – 5.0	44.0	10	45.0	14.4
33811-5.0-5.5-25-10	5.0 – 5.5	44.0	10	45.0	14.4
33811-5.3-5.9-25-10	5.3 – 5.9	44.0	10	45.0	14.4
33811-5.9-6.4-25-10	5.9 – 6.4	44.0	10	45.0	14.4
33811-6.4-7.2-25-10	6.4 – 7.2	44.0	10	45.0	14.4
33811-7.1-7.8-22.5-10	7.1 – 7.8	43.0	10	44.5	13.2
33811-7.7-8.5-22.5-10	7.7 – 8.5	43.5	10	44.5	13.2
34811-8.5-9.6-20-10	8.5 – 9.6	43.0	10	44.0	13.2
34811-9.5-10.5-20-10	9.5 – 10.5	43.0	10	44.0	13.2
34811-10.7-11.7-20-10	10.7 – 11.7	43.0	10	44.0	13.2
32531-3.7-4.2-2.5-30	3.7 – 4.2	34	30	35.5	2.2
32531-4.4-5.0-2.5-30	4.4 - 5.0	34	30	35.5	2.2
33531-5.0-5.5-2.5-30	5.0 - 5.5	34	30	35.5	2.2
33531-5.3-5.9-2.5-30	5.3 - 5.9	34	30	35.5	2.2
33531-5.9-6.4-2.5-30	5.9 – 6.4	34	30	35.5	2.2
33531-6.4-7.2-2.5-30	6.4 – 7.2	34	30	35.5	2.2
33531-7.1-7.8-2.5-30	7.1 – 7.8	34	30	35.5	2.2
33531-7.7-8.5-2.5-30	7.7 – 8.5	34	30	35.5	2.0
34531-8.5-9.6-2.5-30	8.5 – 9.6	34	30	35.5	2.0
34531-9.5-10.5-2.5-30	9.5 – 10.5	34	30	35.5	2.0
34531-10.7-11.7-2.2-30	10.7 – 11.7	33.5	30	35	2.2
34531-11.7-12.2-2.2-30	11.7 – 12.2	33.5	30	35	2.2
35531-12.7-13.2-2.2-30	12.7 - 13.2	33.5	30	35	2.2
35531-14.0-14.5-2.2-30	14.0 – 14.5	33.5	30	35	2.2

Pulsed Power Amplifiers

FOR RADAR APPLICATIONS

- ▶ High Power Output – up to 50 Watt
- ▶ Integrated Power Supply – 16 to 32 Volt
- ▶ Fast Switching – 200 nanosecond
- ▶ Build In Test Circuit
- ▶ Variable Duty Cycle – up to 10%
- ▶ External Synchronization
- ▶ Connectors – SMA Female
- ▶ Load VSWR protected



Model No.	Frequency Range (GHz)	Gain	Power Output
MW-41209-3.7-4.2-20P-35	3.7-4.2	35 dB	43 dBm
MW-41209-7.1-7.7-20P-35	7.1-7.7	35 dB	43 dBm
MW-41209-8.5-9.6-20P-35	8.5-9.6	35 dB	43 dBm
MW-41209-9.7-10.7-10P-30	9.7-10.7	30 dB	40 dBm
MW-41209-10.7-11.7-10P-30	10.7-11.7	30 dB	40 dBm

TWTA Replacement

SOLID STATE AMPLIFIER

- ▶ High MTBF
- ▶ No Maintenance Required
- ▶ Easy installation
- ▶ Energy Efficient
- ▶ High Channel Loading Capacity
- ▶ Cost Effective

Elisra's solid state Traveling Wave Tube Amplifier retrofit Family is an ideal, cost-effective solution for replacing TWTAs with solid state modern technologies.

Available in various frequency bands, these are complete fit form and functionalist replacements installable within an hour.

Applications

Terrestrial microwave links have been used for many years as a cost-effective to physical telephone lines, providing a reliable efficient and versatile medium. Many of these links contain traveling wave tube amplifiers (TWTAs) at their transmitter end.

These amplifiers age at a very high rate and require and frequent adjustments and replacement.

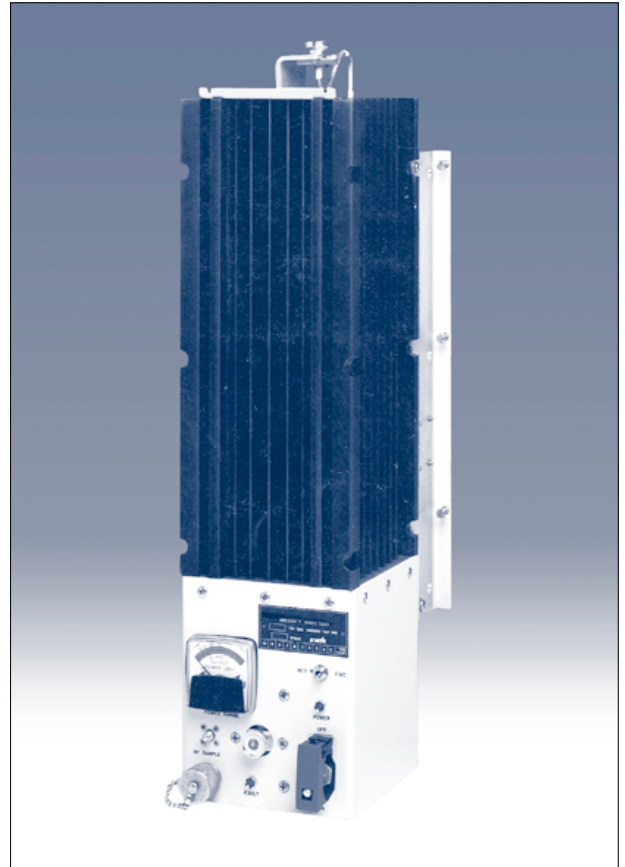
This high maintenance item can be eliminated by replacing the old tubes with solid state amplifiers, which have inherently higher MTBF, can eliminate this high maintenance item and stability. Other benefits are lower current consumption and dramatically reduced maintenance costs. Installation is very simple and fast, and does not require any modification of the existing infrastructure.

Solid state amplifiers are directly competitive in initial price with TWT amplifiers.

Taking in account the long-term savings, the retrofit is very cost efficient.

Product Description

Elisra offers a complete range of solid state power amplifiers and retrofit accessory kits to replace



TWTAs and their associated power supplies, in terrestrial point-to-point microwave transmitters.

Units with up to 50 watts output power are available at various frequency bands, from 1 to 18 GHz. They are complete form and fit replacements as they fit into the existing racks, thus preserving the customer's investments.

Solid state GaAs FET technology carries many advantages over tubes much higher (about 10 times) MTBF, longer shelf time, lower DC voltage supply, lower cooling requirements and no warm-up time. All these significantly reduce cost and increase life cycle. They maintain uniform output power along their life span and require no periodical alignments. This results in a quieter system with increased availability and higher channel loading capacity.

Elisra's units are compatible with various modulation



types. FM, OPSK, BPSK, PM, 160AM 64QAM.

The unit's internal and external DC converters can operate from primary voltage determined by the user from a wide range of options +24V -24V, -48V, or a - 18 to -72VDC source.

The amplifiers are protected against reverse polarity and power supply failure by means of a parallel diode and serial fuse.

They have a thermostat-based, built-in automatic shut down mechanism as protection from burn-out due to accidental overheating.

Additionally, the amplifiers are protected against any input/output infinite VSWR.

Retrofit amplifiers are also available with an input attenuator capable of accepting any RF power level between -10 and + 10dBm. This feature permits installation without the need for any adjustment at any of the previous stages.

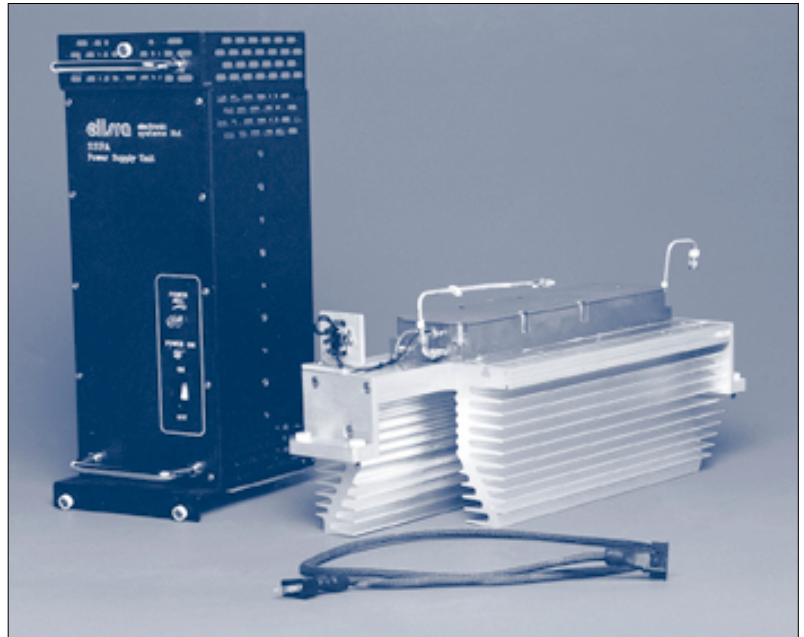
Complementary Products

Elisra's Power Booster and Microwave links Repeater complement the product line for telephone and radio/TV microwave links.

Retrofit Products

The following are some of the radio models which can be retrofitted by Elisra's amplifiers.

Manufacturer	Product
Siemens	CTR 147, CTR148, CTR 106, RM 1800-TV4000FM1800-TV6000, FM 2700-TV6700, FM 960-TV7500, DRS-140-11200, DRS-140-13000 DRS-140-15000
Philips	SR600
SEL	775C, 775D, FM180, DRS-140-6700, DRS-140-11200
STC	3.7-4.2 GHz
GES/Marconi	GEC 10/55 R680
NEC	TR-6G 1800-GA,A,B,TR-6GV-2A,3A
AT&T	OR6/135
Collins/Alcatel	MDR2306



TWTAs SELECTION REPLACEMENT*

The following are some of the Traveling Wave Tubes models which can be retrofitted by Elisra's amplifiers.

Manufacturer	Product
Siemens	RW 2 RW 2P.RW 3 RW 21 RW 42, RW 48, RW 48M, RW 80, RW 81, RW 85, RW 88, RW 89, RW 90, RW 189, RW 248,RW 289, RW 290, RW 1125, RW 1136, RW 2135, RW 2896
AEG	YH 1110,YH 1207,YH 1195
STC	W5MC175, STCW3MC125

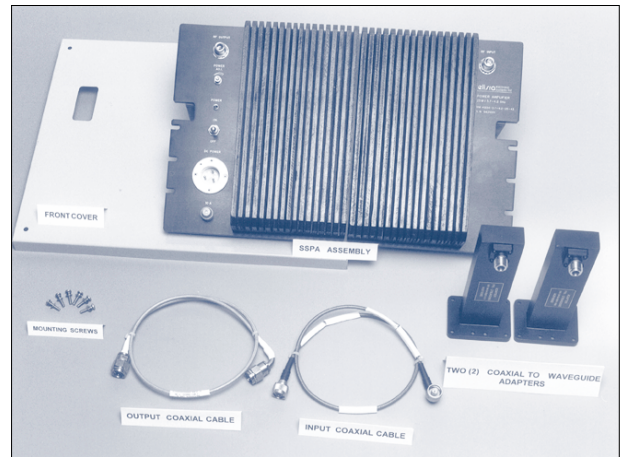
*Partial listing



REPLACEMENT KITS

HIGHLIGHTS

- ▶ Fit, form and function replacement
- ▶ High reliability
- ▶ Easy installation



Model Number Typical Specifications	Frequency (GHz)	Power Output at 1 dB GCP (dBm)	Nominal Gain (dB)	Power Output (dBm)
MW4127-1.7-2.1-20-40	1.7-2.1	42.5	40	43.5
MW4127-1.9-2.3-20-40	1.9-2.3	42.5	40	43.5
MW4127-2.2-2.5-20-40	2.2-2.5	42.5	40	43.5
MW4127-2.4-2.7-20-40	2.4-2.7	42.5	40	43.5
MW4127-3.4-3.8-20-40	3.4-2.7	42.5	40	43.5
MW4127-3.5-3.9-20-40	3.5-3.9	42.5	40	43.5
MW4127-3.7-4.2-20-40	3.7-4.2	42.5	40	43.5
MW4127-3.7-4.2-20-40	3.7-4.2	42.5	40	43.5
MW4127-4.4-5.0-20-40	4.4-5.0	42.5	40	43.5
MW4127-5.9-6.5-20-40	5.9-6.5	42.5	40	43.5
MW4127-6.5-6.9-20-40	6.5-6.9	42.5	40	43.5
MW4127-6.8-7.2-20-40	6.8-7.2	42.5	40	43.5
MW4127-7.1-7.7-20-40	7.1-7.7	42.5	40	43.5
MW4127-7.7-8.5-20-40	7.7-8.5	42.5	40	43.5
MW4127-10.7-11.7-10-40	10.7-11.7	39.5	40	40.5
MW4127-12.0-12.5-10-40	12.0-12.5	39.5	40	40.5
MW4127-12.7-13.3-10-40	12.7-13.3	39.5	40	40.5
MW4127-14.0-14.3-10-40	14.0-14.5	39.5	40	40.5
MW4127-14.4-15.3-10-40	14.4-15.3	39.5	40	40.5