Data Sheet

Hybrid RF amplifier

RS stock number 308-556

Introduction

A hybrid thick film RF amplifier designed for use in mast-head booster amplifiers, as a pre-amplifier in MATV systems and as general purpose amplifiers for VHF and UHF applications.

The **RS** OM335 operates from 24Vdc; however, it may be run at reduced supply voltage, the main consequence being a reduction in gain. For example at 12V the **RS** OM335 provides a typical gain of 23 dB compared to 27 dB at 24V dc and the output voltage falls from a minimum of 98 dBµV to 92dB/µV. The flatness of the frequency response is little affected and there is no change in noise figure down to a supply voltage of 12V.

Conversion table for 75 ohm impedance

dBµV	mV	dBm
90	31,6	–18,75
92	39,8	–16,75
94	50,1	–14,75
96	63,1	–12,75
98	79,4	–10,75
100	100,0	–8,75
102	125,9	–6,75
104	158,5	–4,75
106	199,5	–2,75
108	251,2	–0,75
110	361,2	1,25
112	398,1	3,25
114	501,2	5,25
116	631,0	7,25

RS OM335

Electrical characteristics

Ratings: Limiting in accordance with the Absolute Maximum System (IEC 134)

Operating ambient temperature	T_{amb}		–20 to +70°C
Storage temperature	T_{stg}		–40 to +125°C
dc supply voltage	V_B	max.	28V
Peak voltages on pins 1 and 7	$-V_{1M}$, $-V_{7M}$	max.	28V
	$-V_{1M}$, $-V_{7M}$	max.	10V
Peak incident powers on pins 1 and 7	P_{I1M}, P_{I7M}	max.	100mW

Characteristics:

Measuring conditions

Ambient temperature	T_{amb}	=	25°C
dc supply voltage	V_B	=	24V
Source impedance and load impedance	R_s, Ri	=	75Ω
Characteristic impedance of HF connections	Z_O	=	75Ω
Frequency range	F	=	40 to 860MHz

The output voltage is quoted in dBµV, ie. dB with respect to 1µV. As an aid a conversion table is shown below which shows the output available in mV and in dBm; which is the output with respect to 1mW into 75W impedance.

Extended frequency range performance

The recommended frequency range of these amplifiers is 40 to 860 MHz, however, the upper and lower limits can be extended with some reduction in transducer gain to provide 10MHz to 1.4 GHz coverage. The table below illustrates the performance over the extended range, for the RS OM335.

Frequency (MHz)	Gain (dB)
10	22,5
20	25,2
30	26,0
40	26,2
50	26,3
800	25,6
1000	27,5
1200	20,5
1300	16,3
1400	13,2

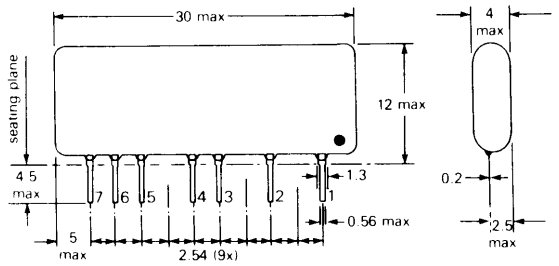
Performance

Supply current	I_B	typ.	35mA
Transducer gain	$G_{tr} = \|S_f\|^2$		23 to 32 dB
		typ.	27dB
Flatness of frequency response	$\pm\Delta\|s_f\|^2$	typ.	1,6dB
Individual maximum v.s.w.r.			
input	$VSWR_{(i)}$	typ.	1,9 (1)
output	$VSWR_{(o)}$	typ.	3,2 (1)
Back attenuation			
F = 100MHz	$\|s_r\|^2$	typ.	46dB
F= 860MHz	$\|s_r\|^2$	typ.	40 dB
Output voltage			
at -60 dB intermodulation distortion		>	98 dBµV
(DIN 45004, par. 6.3: 3-tone)	$V_{o(rms)}$	typ.	101dBµV
1 dB compression		typ.	115 dBµV (2)
Noise figure	F	typ.	5,5 dB

s - parameters: $S_f = S_{21}$ $Si = S_{11}$ $S_r = S_{12}$ $So = S_{22}$

1. Highest value, for a sample, occurring in the frequency range.
2. Measured at saturation for 1dB gain compression.

Figure 1



Terminal connections

1	= Input
2, 3,5, 6	= Common
4	= Supply (+)
7	= Output

Package - Phenoformaldehyde based resin

Soldering recommendations

Hand soldering

Maximum contact time for a soldering-iron temperature of 260°C up to seating plane is 5 s

Figure 2 **Circuit diagram of the RS OM335**

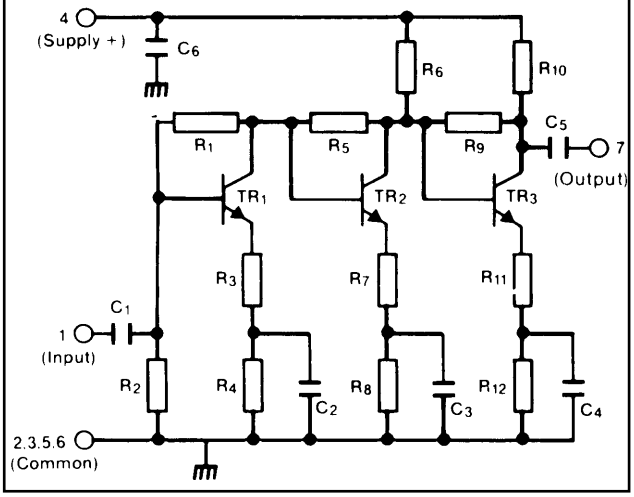


Figure 3 **Mounting recommendations**

The module must be mounted on double-sided printed circuit board, see the example shown below. Input and output should be connected to 75Ω tracks. The connections to the 'common' pins should be as close to the seating plane as possible and soldered on both sides of the board

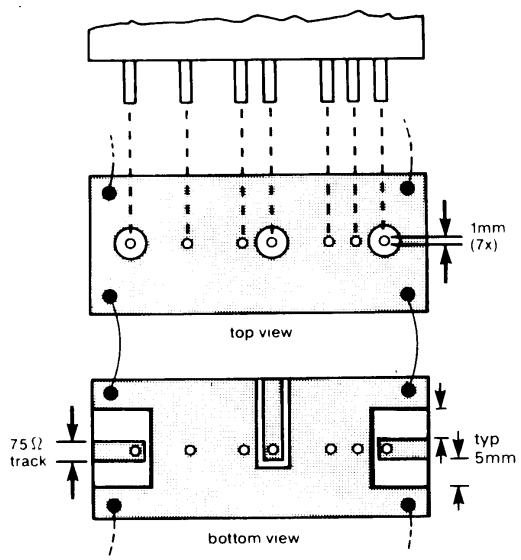


Figure 4 **Frequency response**

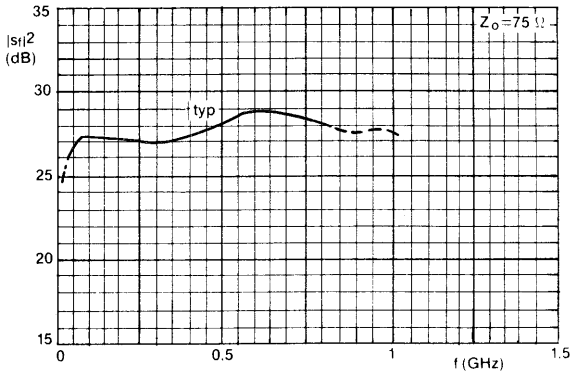


Figure 5 **Input impedance derived from input reflection coefficient s_i, co-ordinates in ohm × 75.**

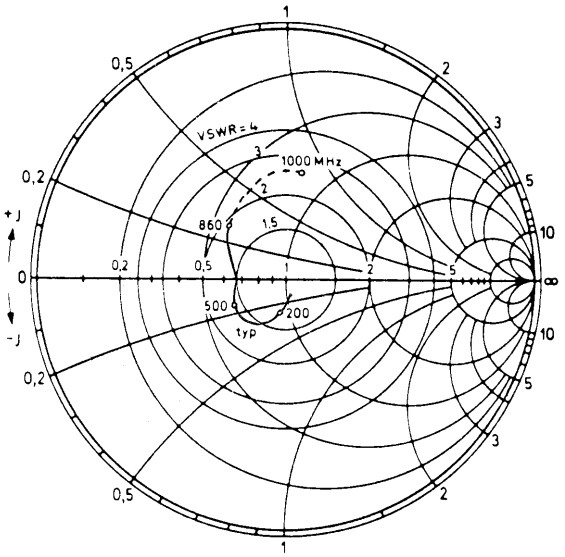
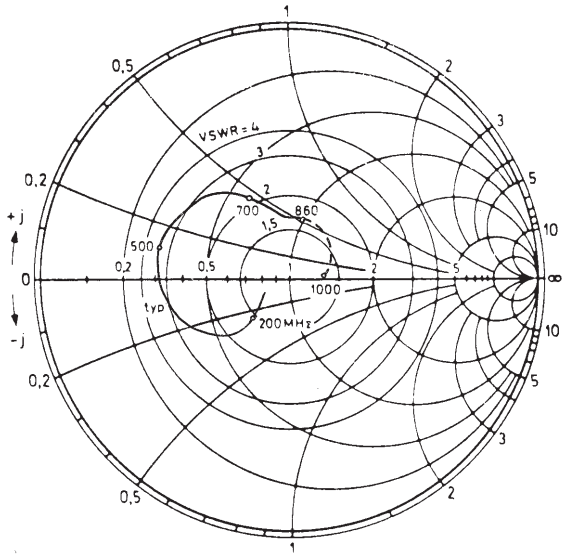


Figure 6 **Output impedance derived from output reflection coefficient s_o, co-ordinates in ohm × 75**



Design hints for layout of printed circuit boards

Single sided boards

Due to the high gain of the wideband amplifier modules, the use of single-sided printed circuit boards is not recommended. Oscillatory problems, which can easily arise, are extremely difficult to overcome. The use of additional metal screening will help but usually performance is degraded.

Double sided boards

Double sided boards are preferred for module mounting (Figure 3). The track width depends on the thickness and material of the printed circuit board used. For a characteristic impedance of Zo = 75W, using epoxy glass boards without neighbouring areas of copper, the track should be approximately the same thickness as the thickness of the board. If mass-areas of copper (eg. ground plane) are closer than 5mm to the 'hot strip' parasitic influences will disturb the characteristic impedance, and hence, the matching. If the lengths of the 75W track are smaller than, say 1cm, the width is less critical.

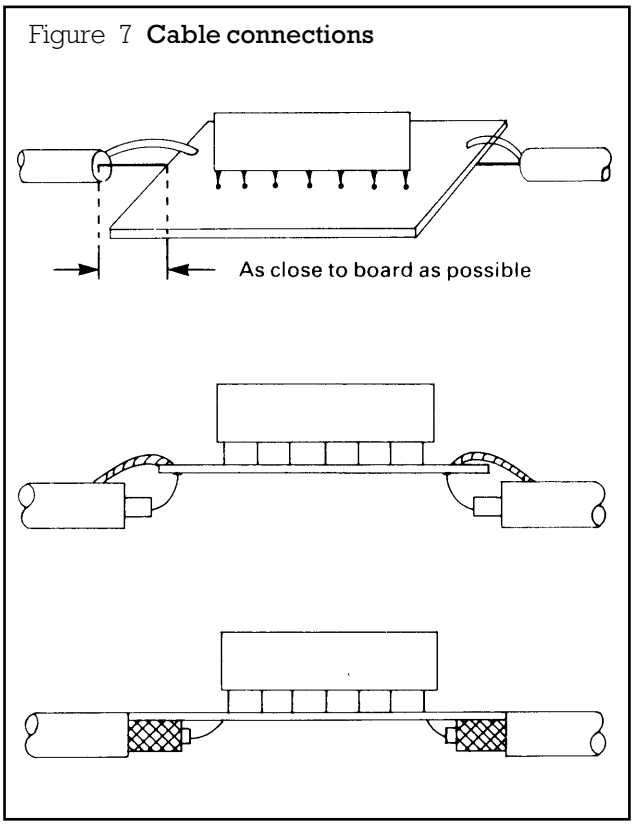
Amplifier cascading

Due to the high gain obtainable from two cascaded wideband amplifiers, the printed circuit board layout must meet very stringent requirements, and unless UHF construction techniques are strictly adhered to, cascading should not be attempted.

Cable connections

Recommendations for the connection of a coaxial cable to the printed circuit board are shown in Figure 7.

Figure 7 **Cable connections**



General

To obtain the best results from these devices it is necessary to have an appreciation of UHF techniques. In particular the following points should be observed:

1. A printed circuit board, preferably double sided, should be used with the track dimensions calculated in accordance with Stripline theory. The layout shown in Figure 3 give good gain, however, suitability will depend on the grade of board used and the intended operating frequency.
2. Ideally the printed circuit board should be enclosed in a screened metal box (Figure 8) with the input and output sockets situated so as to enable short, direct, connections to be made.
3. Power connections are most conveniently made using lead through capacitors, and an additional capacitor of approximately 1000pF should be connected between the module supply pin and the printed circuit board ground plane, as close as possible to the module.
4. If possible, solder a copper screen perpendicular to the module (Figure 8) and the printed circuit board so that it bridges the module near to the supply pin, thus separating the input and output stages. This will reduce any tendency to oscillate.
5. One technique to reduce parasitic oscillation is to ensure that the mass areas shown hatched in Figure 3 are interconnected. This can be achieved using 'through board' connections 5mm apart and 5mm from the device forming a 'fence', care must be taken to ensure this does not cause shorting to signal or power tracks.

This device is capable of excellent performance, but great care is necessary in circuit construction to avoid instability. Anyone intending to use these amplifiers with no experience of UHF techniques would be strongly recommended to seek advice from a qualified engineer.

Figure 8 **Box mounting**