PLESSEY
Semiconductors

SL560C

300 MHz LOW NOISE AMPLIFIER

This monolithic integrated circuit contains three very high performance transistors and associated biasing components in an eight-lead T0-5 package forming a 300 MHz low noise amplifier. The configuration employed permits maximum flexibility with minimum use of external components. The SL 560C is a general-purpose low noise, high frequency gain block.

FEATURES (Non-simultaneous)

- Gain up to 40 dB
- Noise Figure Less Than 2 dB (R_S 200 ohm)
- Bandwidth 300 MHz
- Supply Voltage 2-15V (Depending on Configuration)
- Low Power Consumption

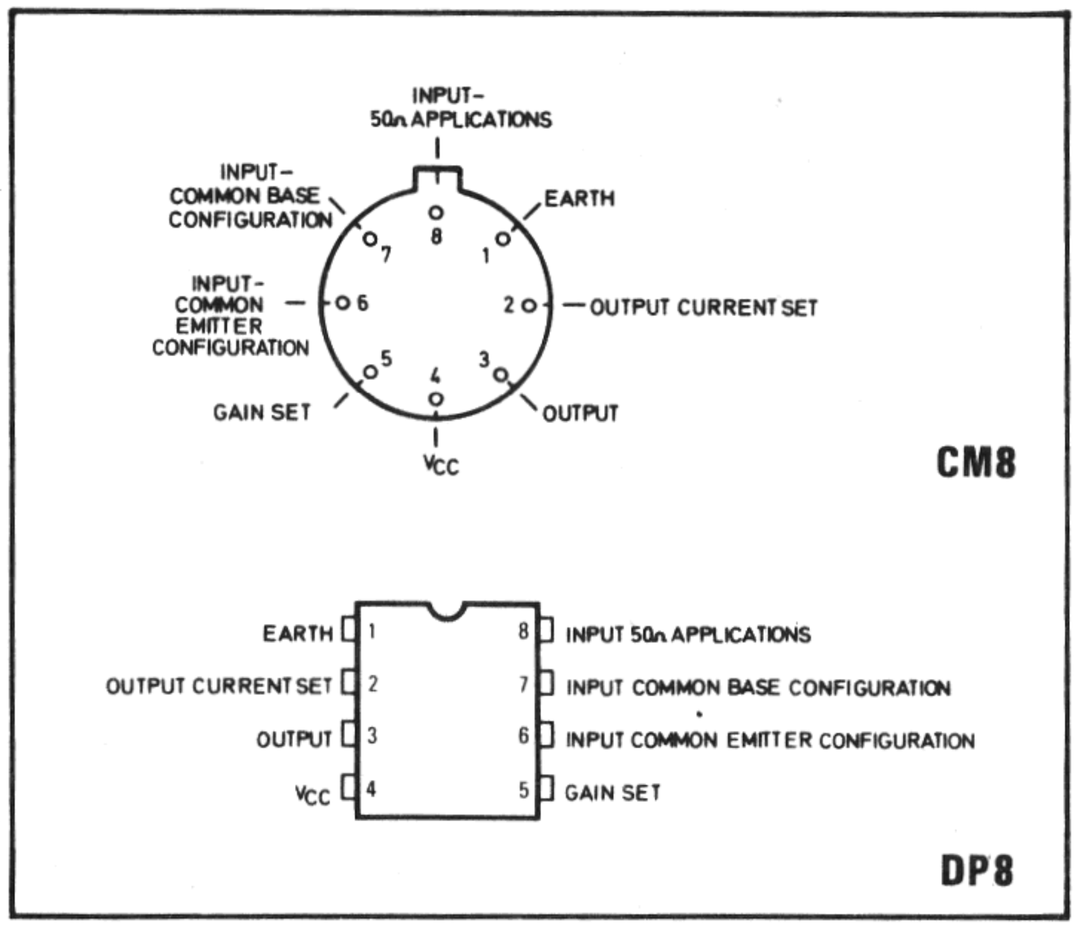


Fig. 1 Pin connections (viewed from beneath)

APPLICATIONS

- Radar IF Preamplifiers
- Infra-Red Systems Head Amplifiers
- Amplifiers in Noise Measurement Systems
- Low Power Wideband Amplifiers
- Instrumentation Preamplifiers
- 50 ohm Line Drivers
- Wideband Power Amplifiers
- Wide Dynamic Range RF Amplifiers
- Aerial Preamplifiers for VHF TV and FM Radio

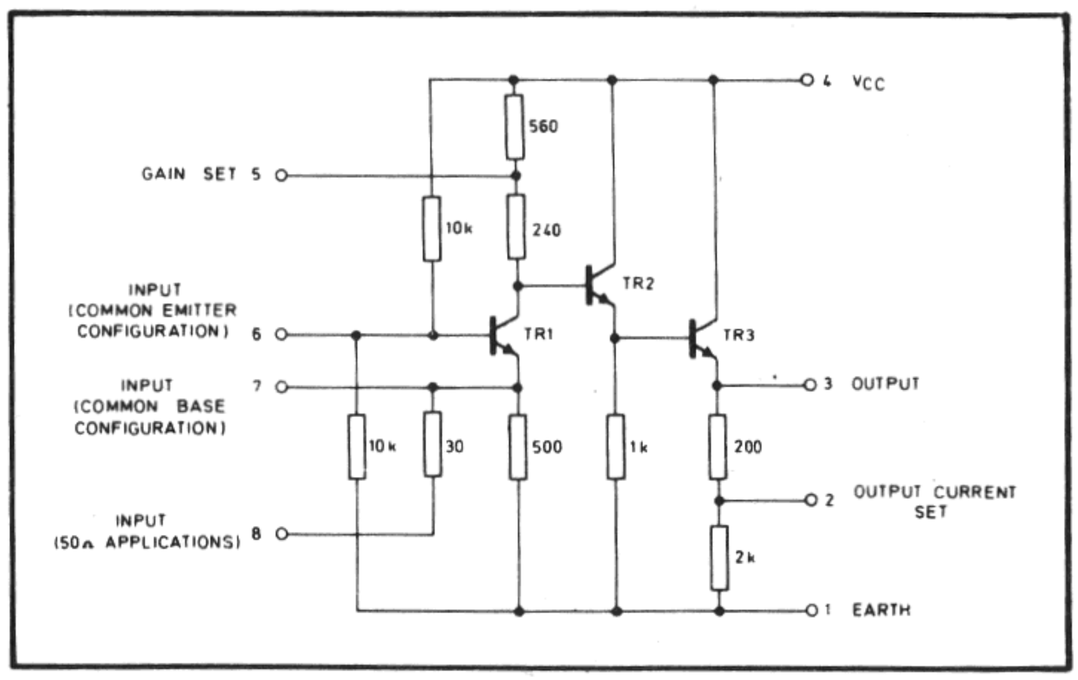


Fig. 2 SL560C circuit diagram

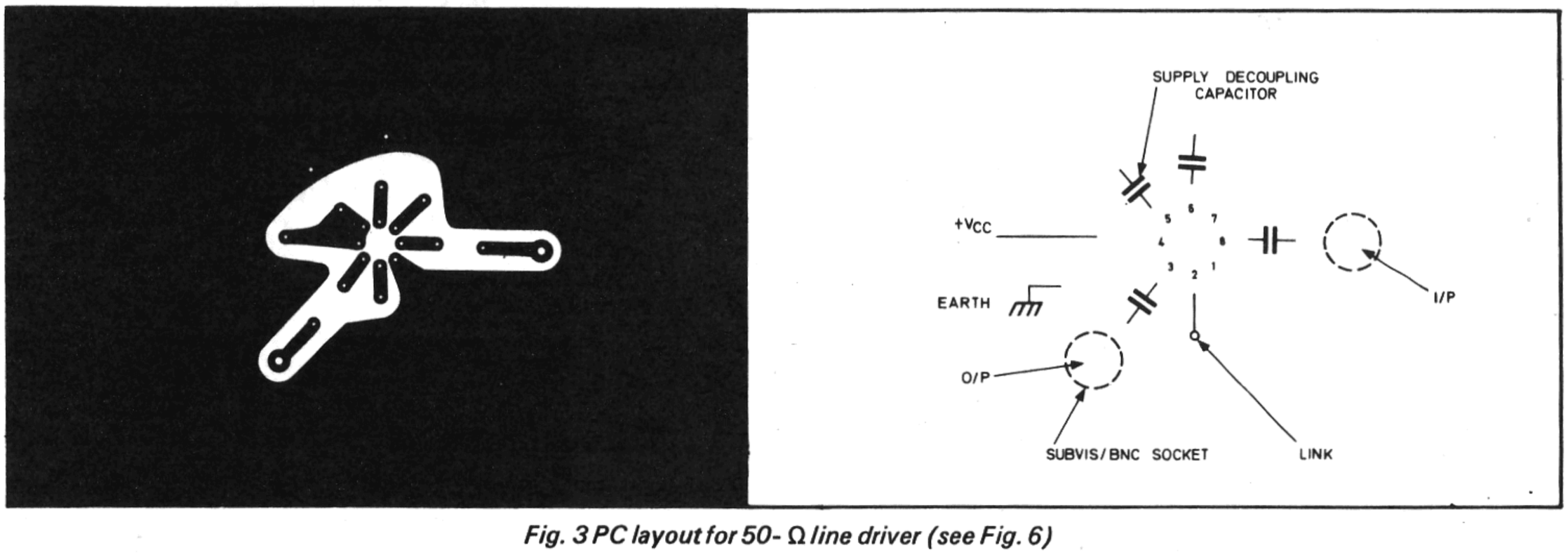


Fig. 3 PC layout for 50- Ω line driver (see Fig. 6)

ELECTRICAL CHARACTERISTICS

Test Conditions (unless otherwise stated):
Frequency 30 MHz
V_{CC} 6V
$R_S = R_L = 50\Omega$
$T_A = 25°C$
Test Circuit: Fig. 6

Characteristic	Value			Units	Conditions
	Min.	Typ.	Max.		
Small signal voltage gain	11	14	17	dB	
Gain flatness		±1.5		dB	10 MHz — 220 MHz
Upper cut-off frequency		250		MHz	
Output swing	+5	+7		dBm	V_{CC} = 6V } See Fig. 5
		+11		dBm	V_{CC} = 9V }
Noise figure (common emitter)		1.8		dB	$R_S = 200\Omega$
		3.5		dB	$R_S = 50\Omega$
Supply current		20	30	mA	

CIRCUIT DESCRIPTION

Three high performance transistors of identical geometry are employed. Advanced design and processing techniques enable these devices to combine a low base resistance ($R_{bb'}$) of 17 ohms (for low noise operation) with a small physical size — giving a transition frequency, f_T, in excess of 1 GHz.

The input transistor (TR1) is normally operated in common base, giving a well defined low input impedance. The full voltage gain is produced by this transistor and the output voltage produced at its collector is buffered by the two emitter followers (TR2 and TR3). To obtain maximum bandwidth the capacitance at the collector of TR1 must be minimised. Hence, to avoid bonding pad and can capacitances, this point is not brought out of the package. The collector load resistance of TR1 is split, the tapping being accessible via pin 5. If required, an external roll-off capacitor can be fixed to this point.

The large number of circuit nodes accessible from the outside of the package affords great flexibility, enabling the operating currents and circuit configuration to be optimised for any application. In particular, the input transistor (TR1) can be operated in common emitter mode by decoupling pin 7 and using 6 as the input. In this configuration, a 2 dB noise figure ($R_S = 200\ \Omega$) can be achieved. This configuration can give a gain of 35dB with a bandwidth of 75 MHz (see Figs. 8 and 9) or, using feedback, 14 dB with a bandwidth of 300 MHz (see Figs. 10 and 11).

Because the transistors used in the SL 560C exhibit a high value of f_T, care must be taken to avoid high frequency instability. Capacitors of small physical size should be used, the leads of which must be as short as possible to avoid oscillation brought about by stray inductance. The use of a ground plane is recommended.

Further applications information is avaiable in the 'Broadband Amplifier Applications' booklet.

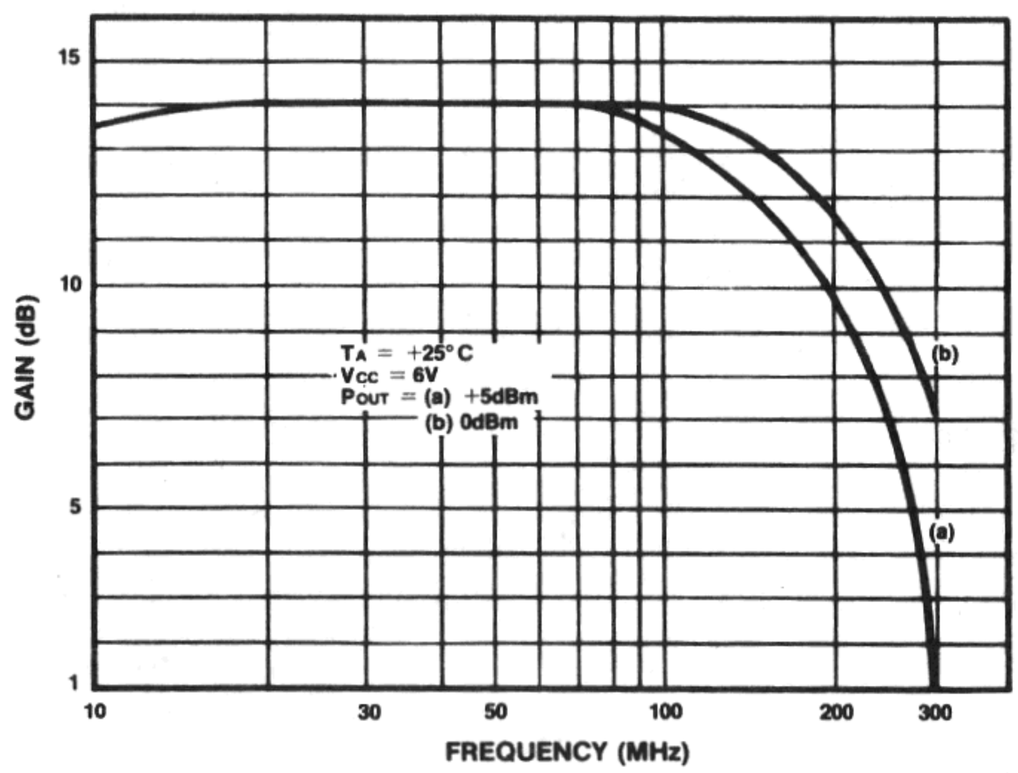


Fig. 4 Frequency response, small signal gain

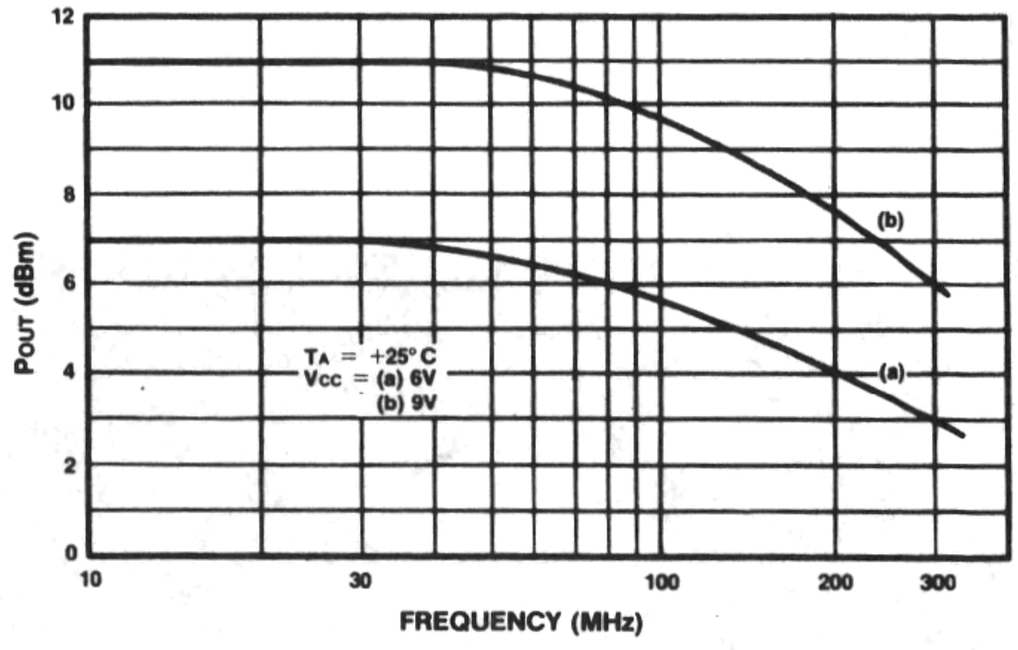
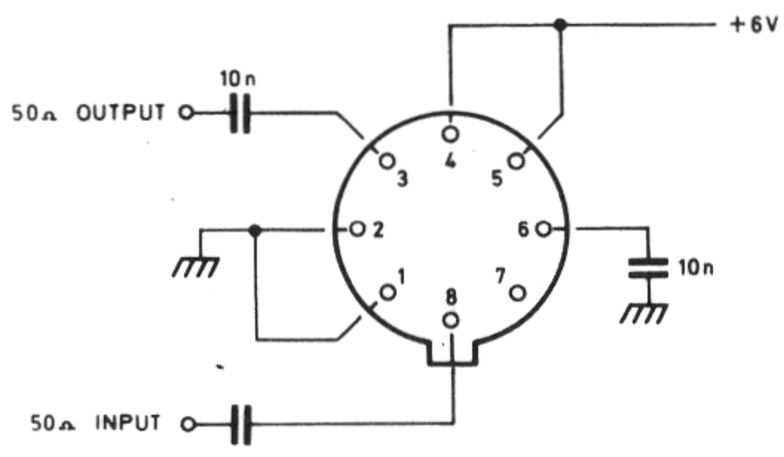


Fig. 5 Frequency response, output capability (loci of maximum output power with frequency, for 1dB gain compression)

TYPICAL APPLICATIONS



Gain 14dB
Bandwidth 220 MHz (P_{out}=1mW, 50 Ω)
200 MHz (P_{out}=5mW, 50 Ω)
Input SWR 1.5 :1

Fig. 6 50 Ω line driver. The response of this configuration is shown in Fig. 4.

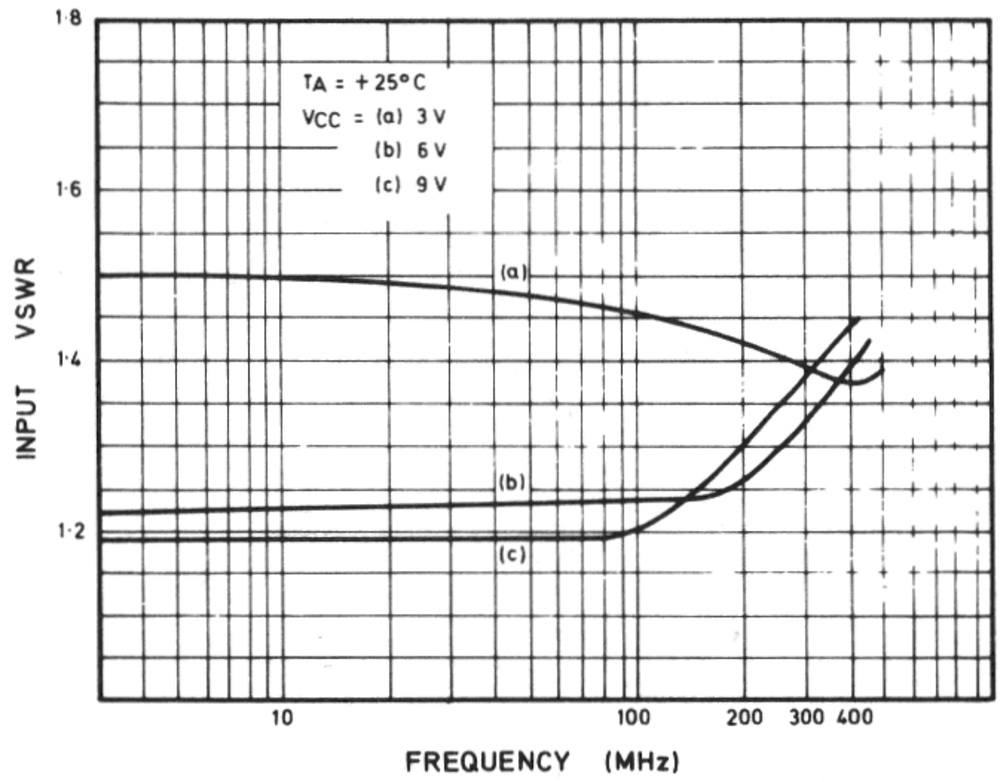
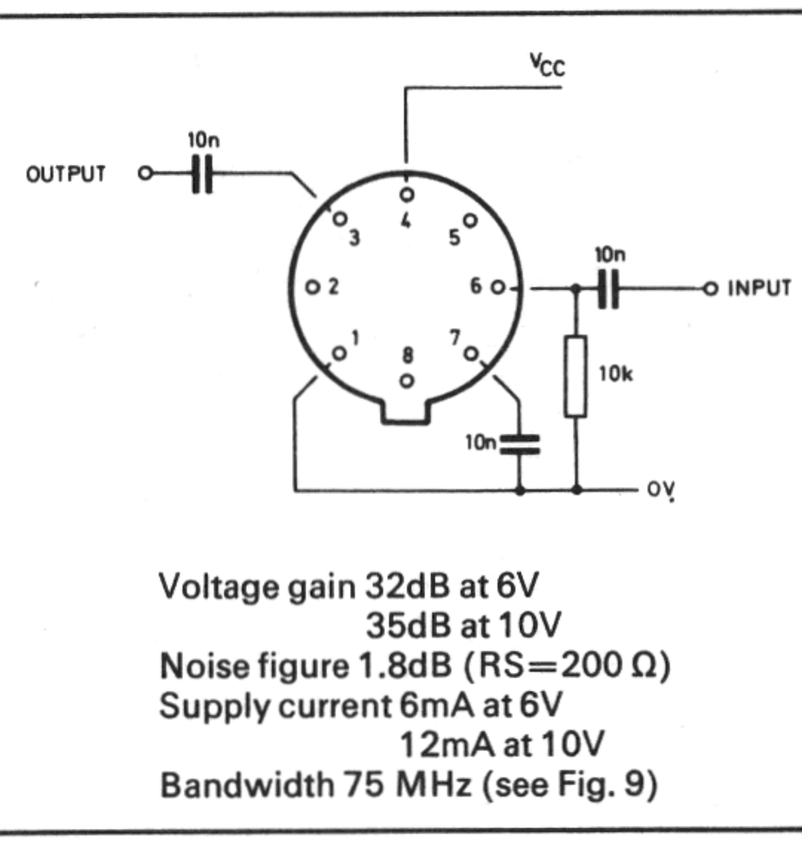


Fig. 7 Input standing wave ratio plot of circuit shown in Fig. 6



Voltage gain 32dB at 6V
35dB at 10V
Noise figure 1.8dB (RS=200 Ω)
Supply current 6mA at 6V
12mA at 10V
Bandwidth 75 MHz (see Fig. 9)

Fig. 8 Low noise preamplifier

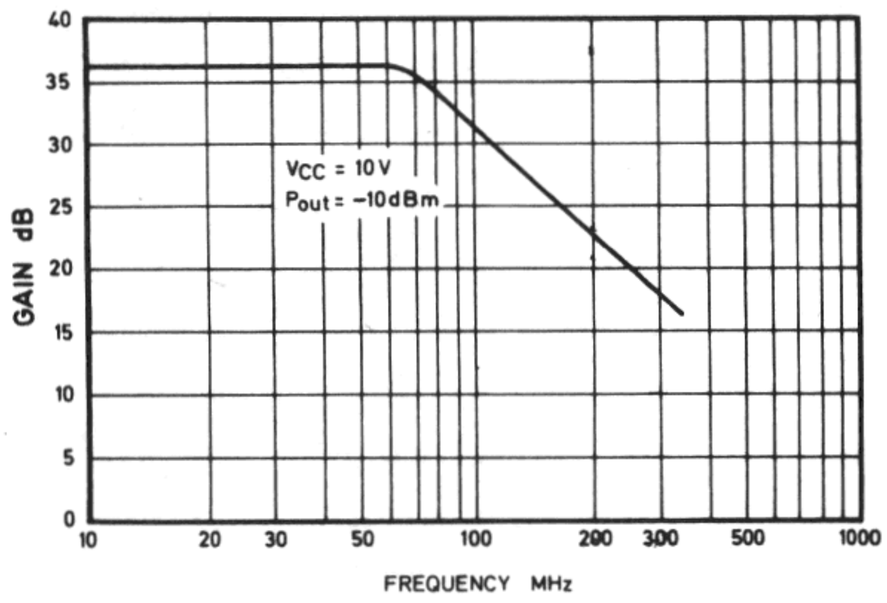
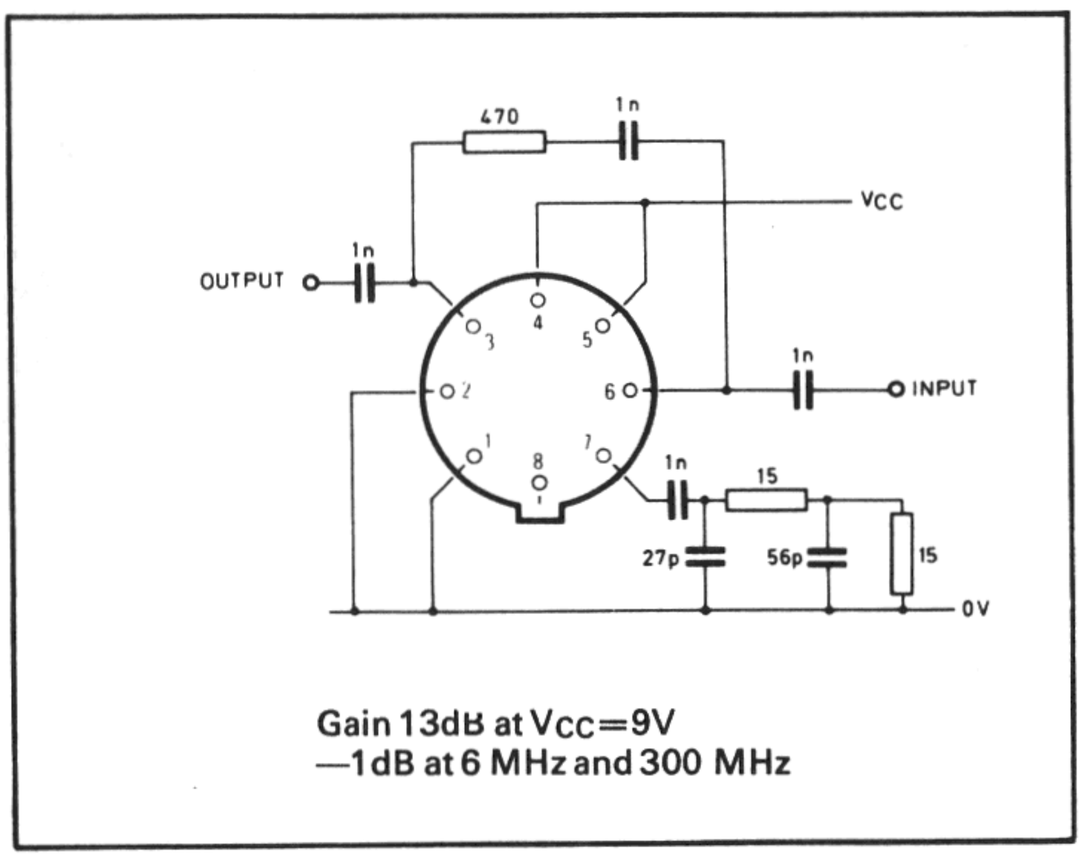


Fig. 9 Frequency response of circuit shown in Fig. 8



Gain 13dB at Vcc=9V
—1dB at 6 MHz and 300 MHz

Fig. 10 Wide bandwidth amplifier

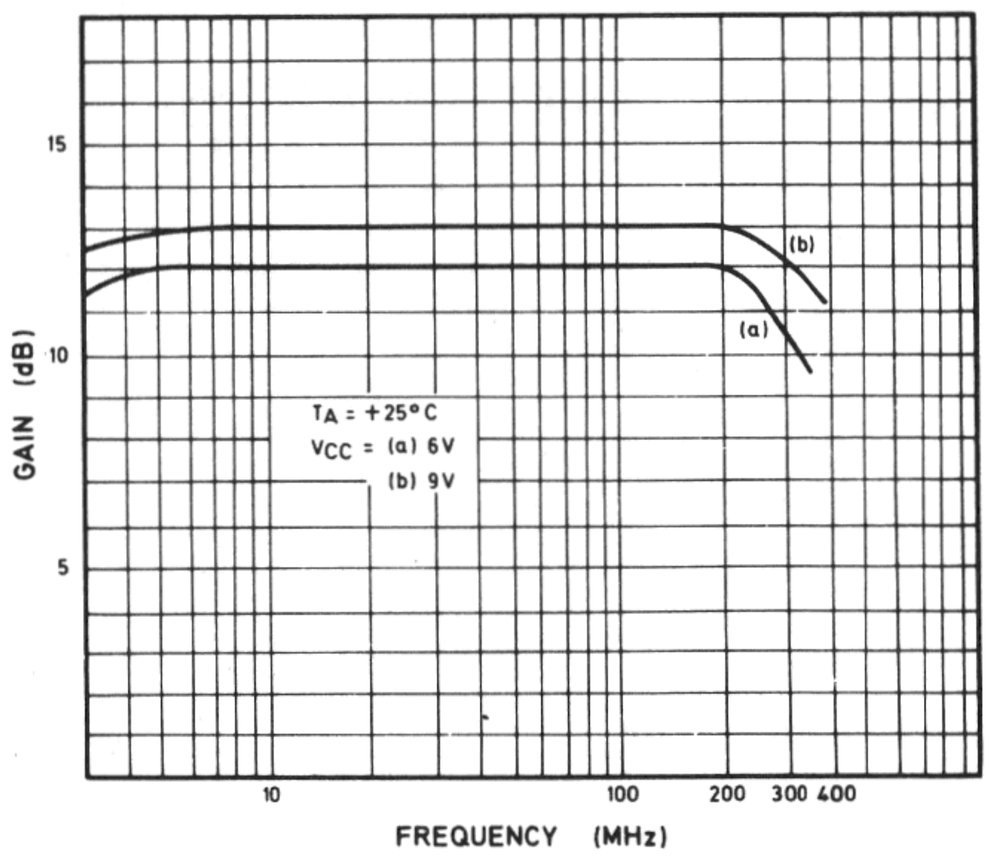


Fig. 11 Frequency response of circuit shown in Fig. 10

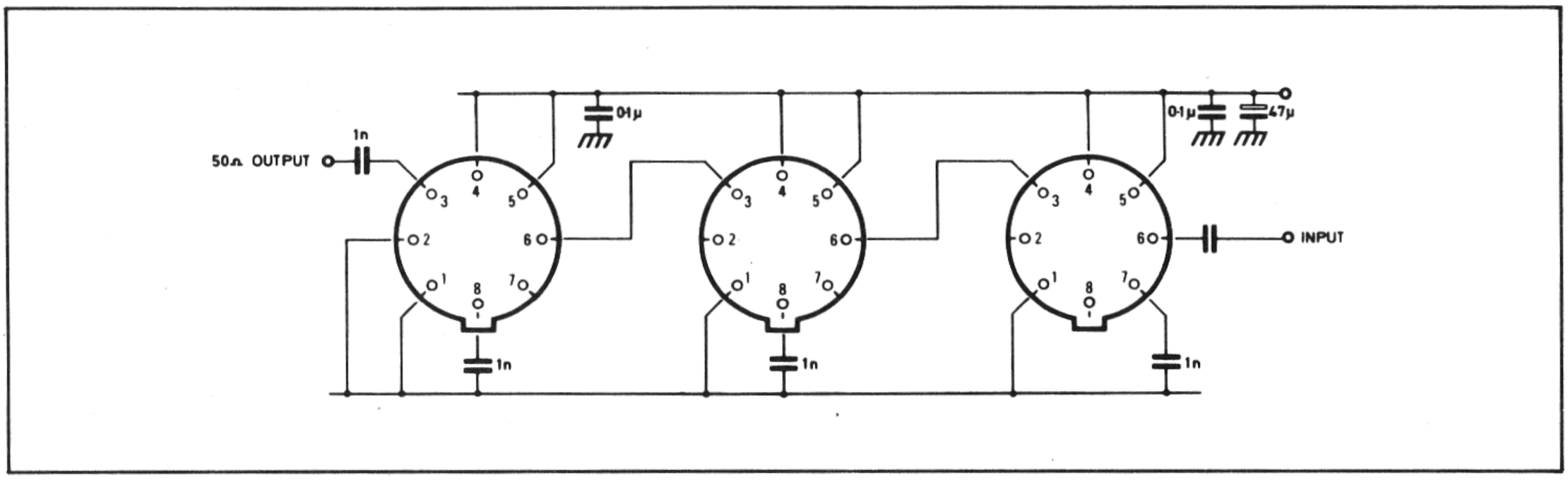


Fig. 12 Three-stage directly-coupled high gain low noise amplifier

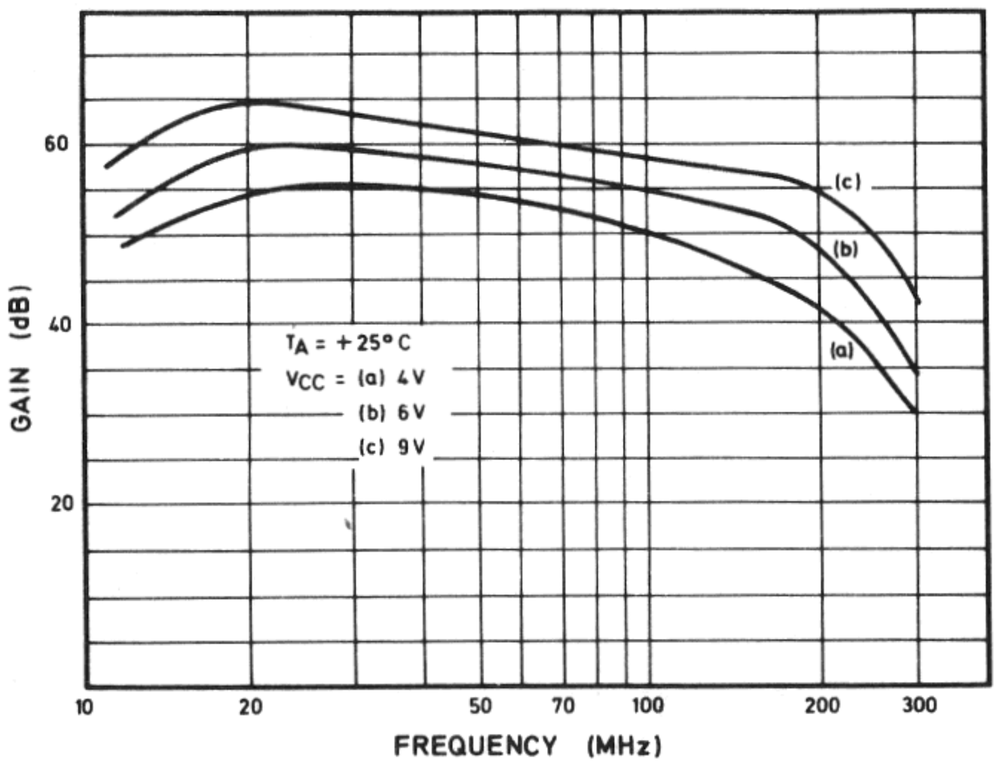
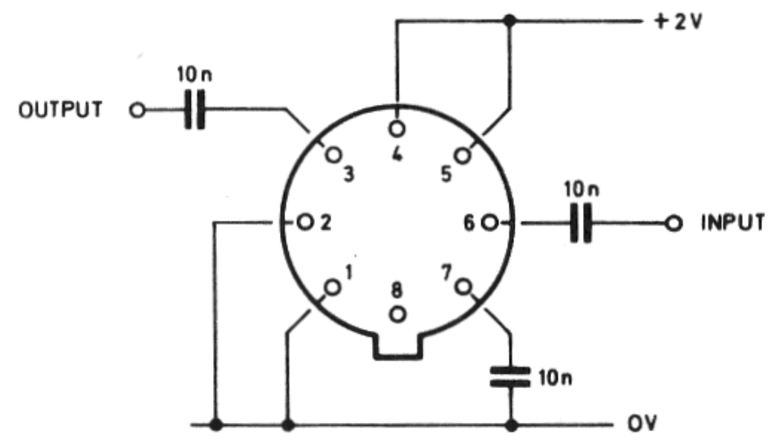


Fig. 13 Frequency response of circuit shown in Fig. 12



Gain 13dB
Power supply current 3mA
Bandwidth 125 MHz
Noise figure 2.5dB (RS=200 Ω)

Fig. 14 Low power consumption amplifier

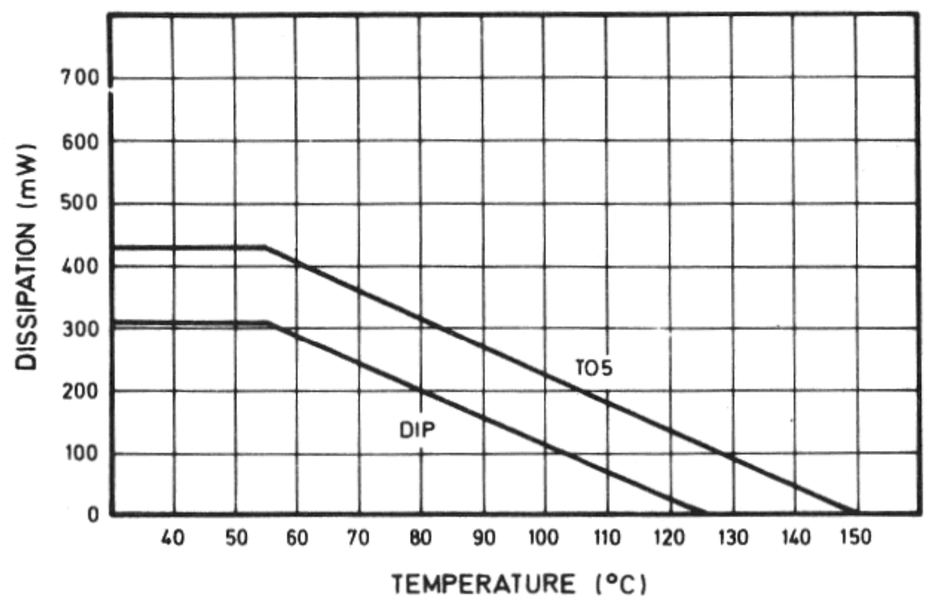


Fig. 15 Ambient operating temperature v. degrees centigrade

ABSOLUTE MAXIMUM RATINGS

Supply voltage (Pin 4)	+15V
Storage temperature	−55°C to 150°C (CM)
	−55°C to 125°C (DP)
Junction temperature	150°C (TO5) 125°C (DIP)
Thermal resistance	
Junction-case	60°C/W (TO5)
Junction ambient	220°C/W (T05) 230°C/W (DIP)
Maximum power dissipation	See Fig. 15
Operating temperature range	−55°C to +125°C (TO5) at 100 mW
	−55°C to +100°C (DIP) at 100 mW