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# DC TO 8 GHZ MONOLITHIC AMPLIFIER FOR OPTICAL COMMUNICATION

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**Abstract - A monolithic pre-amplifier circuit with wide bandwidth of DC to 8 Ghz has been developed for fast fibre optic communication. Employment of half micron GaAs technology and microwave matching techniques in circuit design made possible this very broad bandwidth. Measured results correspond well to the design values.**

Two goals were kept in mind when designing the amplifier: Firstly, it should be DC-coupled with as wide bandwidth as possible and have resonable input match to 50 Ω. Secondly, it should have low noise when connected to a photo diode with low capacitance (typically 0,3 pF).

Figure 1 shows the schematic diagram of the amplifier. It is a two-stage transimpedance amplifier, where each stage consists of a common-source amplifier and a common-drain buffer. Normal microwave techniques were used in circuit design. To get wide bandwidth, spiral inductors, by-pass capacitors at the level shifting diode chains and compensating capacitor at the feedback path are used. Good output matching is obtained with a 240 $\mu$m common drain stage [1].

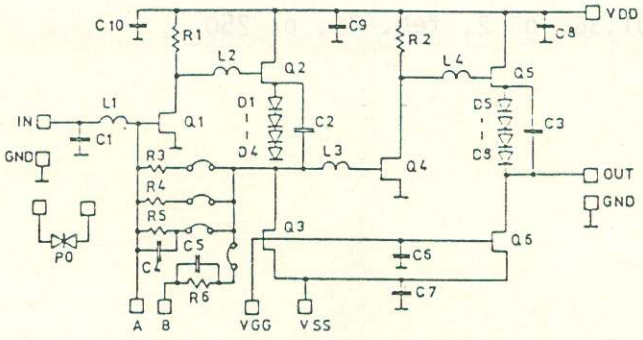


**Fig.1** Schematic diagram.

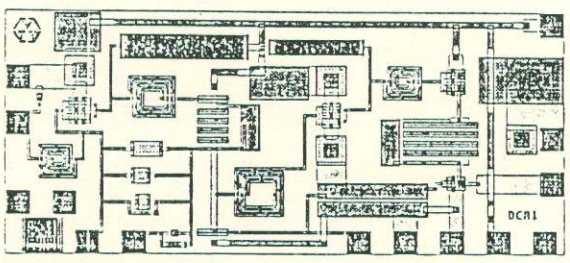

**Fig.2** Lay-out.

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In order to accommodate both of the intended applications with source impedance either 50 Ω or a photo diode, the parallel feedback resistor is made adjustable. In normal conditions it is 250 Ω, which provides return loss of about -10 dB and flat gain upto 8 GHz to a 50 Ω source. By breaking air-bridges on the chip, a higher value of feedback resistor up to 1500 Ω is obtained. This results in lower noise current at the input with photo diode as a source.

Figure 2 shows the lay-out of the amplifier. The chip size is 1mm x 2mm. The circuit was fabricated at Anadigics within Nordic NOGAP-project [1]. The technology includes MESFETs with 0,5 μm gates, air-bridges, substrate via-holes, mesa isolation, thin film resistors and capacitors.

Three amplifiers were measured directly from the chip using a microwave wafer prober. Figure 3 shows calculated gain and input match (with 250 Ω feedback resistor) and the corresponding measured curves are in figure 4. The measured gain of about 11 dB and 3dB bandwidth of about 8 GHz are very near to the calculated values. The measured input return loss is about -10 dB, output match is better than -20 dB and isolation ($s_{12}$) is better than -40 dB.

Reference:

[1] NOGAP 1986-88. Final report. ELAB Report STF40 A89036. Trondheim, Norway. 1989.

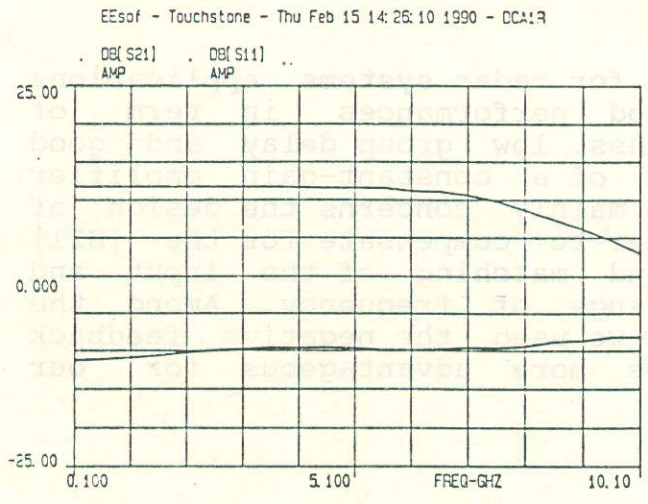


Fig. 3 Calculated gain and input match.

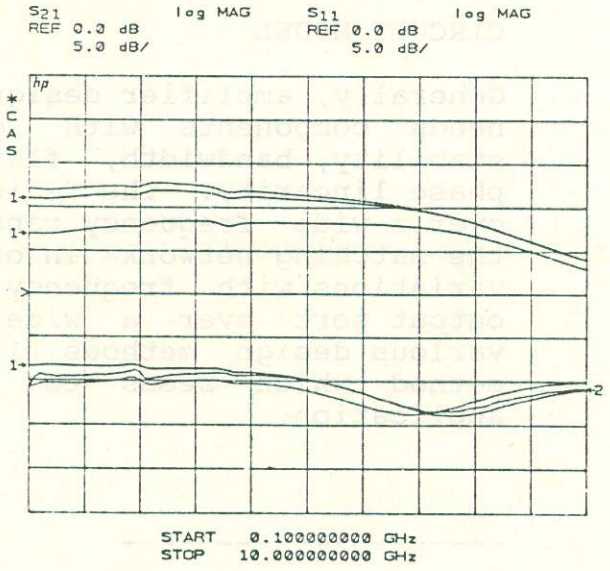


Fig. 4 Measured results for three amplifiers.