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(71) Applicant: **PLESSEY OVERSEAS LIMITED**
Vicarage Lane
Ilford Essex IG1 4AQ(GB)

(72) Inventor: **Oxley, Christopher Hunter**
67 Brackley Road
Towcester Northants(GB)
Inventor: **Holden, Anthony James**
53 Pavillion Way
Brackley Northants(GB)

(74) Representative: **Sorenti, Gino**
Intellectual Property Department The
Plessey Company plc 2-60 Vicarage Lane
Ilford Essex IG1 4AQ(GB)

(54) **Balun circuits.**

(57) A Balun circuit for an integrated circuit having a small area and constructed using known semi-conductor fabrication processes. The balun circuit comprises two metallic strips (3,5) on a dielectric substrate 1 the strips (3,5) being substantially parallel to one another with a gap (7) there between and the second strip 5 having a length to be equal to a quarter wavelength of the input signal, the values of the gap and strip widths (13,19) being predetermined such that the output impedances of the first and second metallic strips (3,5) respectively are substantially equal.

EP 0 213 864 A2

BALUN CIRCUITS

The present invention relates to Balun circuits and more particularly but not exclusively to Balun circuits which have a co-planar arrangement.

Balun circuits allow coupling of balanced and unbalanced lines in for example telecommunications systems. Previously, balun circuits have been constructed using coils or quite complex linear patterns and have thus required relatively large areas to accommodate them, creating problems in compatibility with integrated circuits.

Our balun circuit can be included in an integrated circuit having a small area and constructed using known semiconductor fabrication processes.

Accordingly the present invention provides a balun circuit for an input signal of a particular wavelength comprising:-

a dielectric substrate,

a first metallic strip on the surface of the substrate having an input to receive the input signal and a first output; and,

a second metallic strip, also on the surface of the substrate with a second output and with an end pinned to a reference voltage,

the first and second metallic strips being substantially parallel to one another with a gap there between whereby the strips mutually induct,

the second metallic strip having a length to be equal to a quarter the wavelength of the input signal, the values of the gap and strip widths being predetermined such that the output impedances of the first and second metallic strips respectively are substantially equal.

Preferably, the reference voltage will be OV or earth. The outputs of the first and second metallic strips will be fed to a long-tailed transistor pair to give a balanced signal output from the pair. The substrate material may be a ceramic or a semiconductor.

An embodiment of the present invention will now be described by way of example only with reference to the accompanying drawings in which:-

Figure 1 is a schematic view of a balun circuit according to the present invention; and,

Figure 2 is a plan view of a balun circuit of figure 1 with long-tailed transistor pair located at its outputs.

Referring to figure 1, a dielectric substrate 1 has on its surface two metallic strips 3 and 5 parallel to one another and spaced by a gap 7. The first strip 3 has an input part 9 and an output part 11 at either end with a width 13 while the second strip 5 is pinned to earth 15 at one end and has an output part 17 at the other end with a width 19 and length 21. The values of gap 7 and widths 13 and 19 are dictated by the dielectric constant of the substrate and the impedance transformation to be achieved by the balun circuit. The length 21 of the second metallic strip 5 is designed to have substantially a quarter the anti-symmetric mode wavelength of an input signal fed to the input part 9 of the first metallic strip 3.

When a voltage signal V is fed to input part 9, a non-symmetrical signal split occurs between the metallic strips 3 and 5 giving voltage values of V_1 and V_2 at their respective output ports 11 and 17. The voltage signal V sees an input impedance Z whilst voltages V_1 and V_2 correspond to an output impedance Z_L , with input impedance Z being greater than Z_L . Consequently an impedance transformation occurs. The voltage V, applied to strip 3, is alternating, thus a mutual induction occurs between the first and second metallic strips, the strips being coupled magnetically. Thus, dependant on relative areas of strips, asymmetric voltages can be presented at each strip output. As the second metallic strip 5 is pinned to earth 15 at one end, the value of the output of this strip 5 is usually negative when strip 3 is positive and vice versa. The circuit is thus equivalent to an auto-transformer.

Figure 2 shows a balun circuit of figure 1 with a long-tailed pair of field-effect transistors attached to the strip output ports via their source connections. The source 35 of transistor 31 is connected to strip 3 and the source 37 of transistor 33 connected to strip 5. The gates of the transistors 33 and 31 are connected by strip 39 and the output 41 of the long-tailed pair taken across the drains of the transistors 31 and 33. The output 31 is stable and well balanced.

As the balun circuit can be constructed on semiconductor material like gallium arsenide or on ceramics material, for which methods of metal deposition are well known. The use of a semiconductor material, however, presents possibly the best advantages, as this allows the production of monolithic circuits obviating requirement for discrete components.

The dimension of the strip gap 7 and widths 13 and 19 are typically in the range of 10 to 1000 microns.

Claims

1. A Balun circuit for an input signal of a particular wavelength comprising:-

a dielectric substrate,

a first metallic strip on the surface of the substrate having an input to receive the input to receive the input signal and a first output; and,

a second metallic strip, also on the surface of the substrate with a second output and with an end pinned to a reference voltage,

the first and second metallic strips being substantially parallel to one another with a gap there between whereby the strips mutually electrically induct the second metallic strip having a length to be equal to a quarter the wavelength of the input signal, the values of the gap and strip widths being predetermined such that the output impedances of the first and second metallic strips respectively are substantially equal.

2. A Balun circuit as claimed in claim 1 wherein the outputs of the first and second metallic strips are fed to a long-tailed transistor pair giving a balanced signal output from that pair.

3. A Balun circuit as claimed in claim 1 or 2 wherein the reference voltage is zero volts or earth.

4. A Balun circuit as claimed in any preceding claim wherein the substrate material is a dielectric material.

5. A Balun circuit as claimed in any of claims 1 to 4 wherein the substrate material is a semiconductor material.

6. A Balun circuit as claimed in claim 4 wherein the dielectric material is a ceramic.

7. A Balun circuit as claimed in claim 5 wherein the semiconductor material is gallium arsenide.

8. A Balun circuit as claimed in any preceding claim wherein the gap between the first and second metallic strips is between 10 and 1000 micrometres.

9. A Balun circuit as claimed in any preceding claim wherein the widths of the first and second metallic strips are between 10 and 1000 micrometres.

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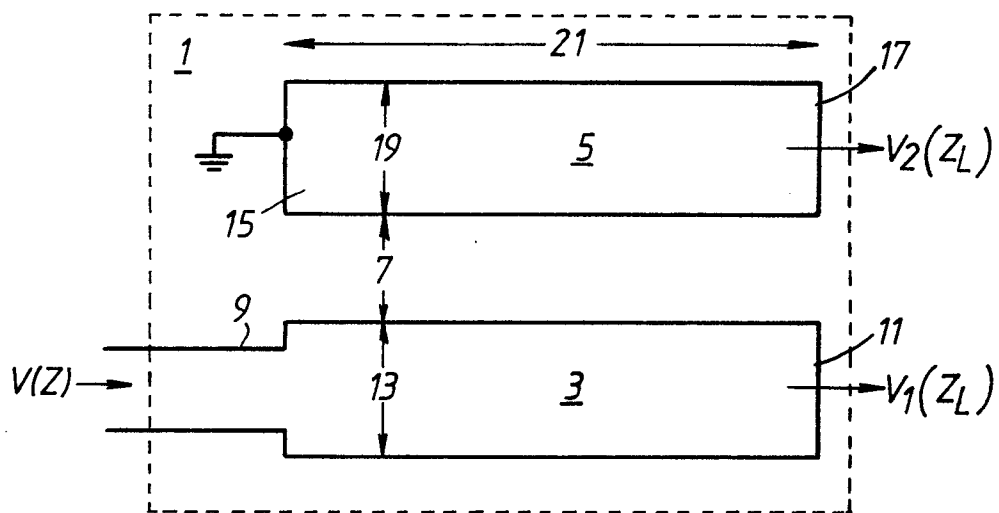


FIG. 1.

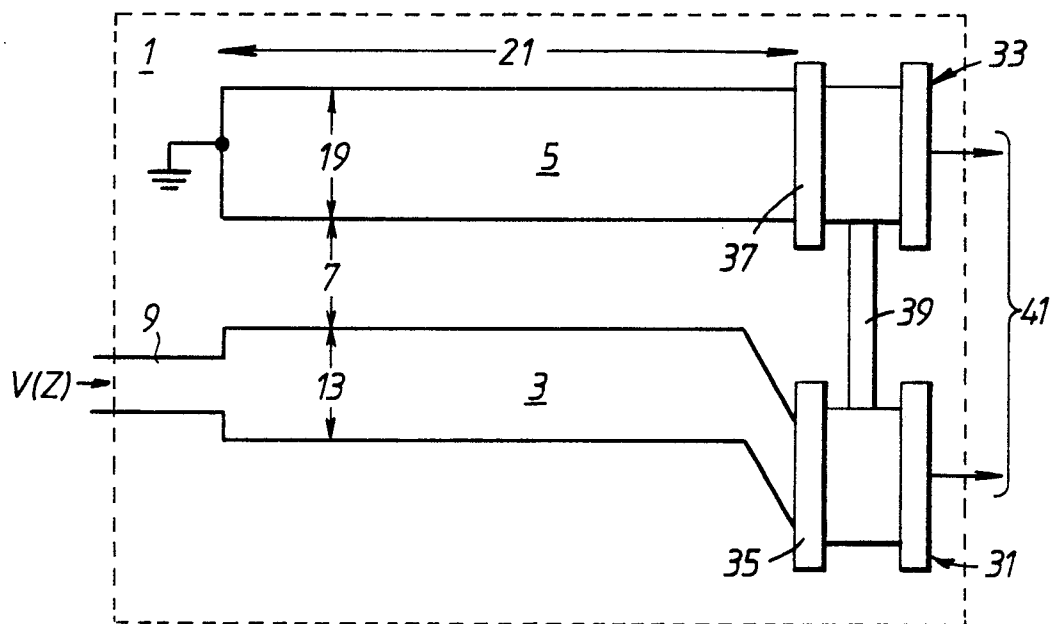


FIG. 2.