# A Broadband Amplifier with Huge Gain-bandwidth Product and Low Power Consumption

Tech ID: 18848 / UC Case 2004-232-0

## BACKGROUND

Without a distributed amplifier, most broadband amplifier bandwidths can be achieved around 1/10 to 1/3 of their fT only. Therefore, a high bandwidth amplifier requires high fT (at least 3-10 times of the amplifier bandwidth) transistors in order to achieve high bandwidth. Unfortunately, the current device technology is limited and in very high fT transistors, yield is still low. This leads to high cost and low yield.

Even if high gain-bandwidth product could be achieved by a distributed amplifier, the major disadvantages of the distributed amplifier are large area, and high dc power consumption.

Transistors were operated with high current density for high fT in order to achieve high bandwidth amplification. However, the transistors would become highly stressed resulting in reliability problems and short lifetimes. 50 ohm terminations are currently employed at the input and output of broadband amplifiers in order to obtain desirable input and output broadband impedance matches (low S11 and S22). However, the disadvantage is 3-dB losses at theirs inputs and outputs.

## TECHNOLOGY DESCRIPTION

University researchers have developed a design method by combining three-stage amplifier design to achieve a broadband amplifier with desirable gain, large bandwidth, low power consumption, low input/output reflection coefficients, low loss, and good reliability. Without a distributed amplifier, the invented broadband amplifier bandwidth of 1/2 of fT and/or approaching to fT can be achieved. Therefore, the amplifiers requires only fT of 1-3 times of the amplifier bandwidth in order to achieve high bandwidth. The broadband amplifier area and dc power consumption will be small and low respectively.

With the invented broadband amplifier, transistors are operated with typical current density, but high amplifier bandwidth can still be achieved. Therefore, the transistors are not stressed at high current density, thus leading to better reliability and long lifecycles. Also, 50 termination is not required in the input and output broadband matching network, therefore, a 3-dB loss is avoidable. S11 can be kept low over the operating bandwidth even with DC supply varied from 0 to 3.3V, and S22 is low over the operating bandwidth as well. This advantage is very useful for broadband amplifiers, and they can be easily cascaded as well.

## APPLICATIONS

The invented broadband amplifier can be applied in fiber-optic communications as a modulator driver, limiting, automatic gain control and as transimpedance amplifiers. It can also be employed in various bands of frequencies as general-purpose amplifiers in wireless communication systems, in testing equipments, and in military electronics warfare systems.

## PATENT STATUS

| Country | Type | Number | Dated | Case |
|---|---|---|---|---|
| United States Of America | Issued Patent | 7,652,539 | 01/26/2010 | 2004-232 |

## CONTACT

Doug Crawford
doug.crawford@uci.edu
tel: 949-824-2405.



## OTHER INFORMATION

## KEYWORDS

amplifier, broadband, low power consumption

## CATEGORIZED AS

- **Communications**
  - Optical
  - Other
  - Wireless
- **Energy**
  - Transmission
- **Sensors & Instrumentation**
  - Other

## RELATED CASES

2004-232-0

UCI Beall
Applied Innovation

5270 California Avenue / Irvine,CA
92697-7700 / Tel: 949.824.2683