THE POSSIBILITIES ARE INFINITE FUJITSU

Motivation for RF Integration

WHITE PAPER

Introduction

While CMOS technology has made great strides in its ability to fabricate radio frequency (RF) circuitry, many RF chip designers have yet to take advantage of this capability. After long relying on more expensive technologies such as silicon germanium (SiGe) and gallium arsenide (GaAs), RF designers who transition to the latest RF CMOS processes gain the enormous advantages of full system-on-a-chip (SoC) integration.

Proliferation of a wide range of wireless applications, from cellular phones to wireless audio/video products, has created enormous opportunities for the semiconductor industry. Although major components in traditional wireless systems have long been fabricated in a variety of CMOS and compound semiconductor process technologies, recent advances in RF CMOS have made it the technology of choice for these applications. RF CMOS is contributing greatly to the successes of wireless products in the marketplace.

The Wireless Landscape

By increasing performance while decreasing cost, wireless semiconductor devices have been key drivers for improving productivity and quality of life for the last two decades. Making phone calls from virtually any location and exchanging text messages and emails has become a way of life.

Instant wireless access to the Internet and location-based services has become affordable and will become ubiquitous in many parts of the world over the next few years. The digital home is being realized with access to high-quality audio and high-definition video anywhere in and around the home—all connected wirelessly. Very-high-speed local and metropolitan wireless networks promise to make the knowledge-based workforce more productive than ever before.

The technologies that make these capabilities available will continue to drive costs down. RF CMOS process technologies are helping to make these products affordable.

The RF System

A typical RF system includes the following basic components:

- Antenna
- RF filter
- Low-noise amplifier
- Mixer
- Oscillator
- Phase-locked loop
- Frequency synthesizer
- Analog-to-digital and digital-to-analog converters
- Power amplifier

Figure 1 is an illustration of an RF system. The baseband processor or the controller, depending on the application, is a system-on-a-chip device that typically contains one or more CPUs, memories, complex logic and analog circuits to make the device function as a cellular telephone, wireless LAN, etc.

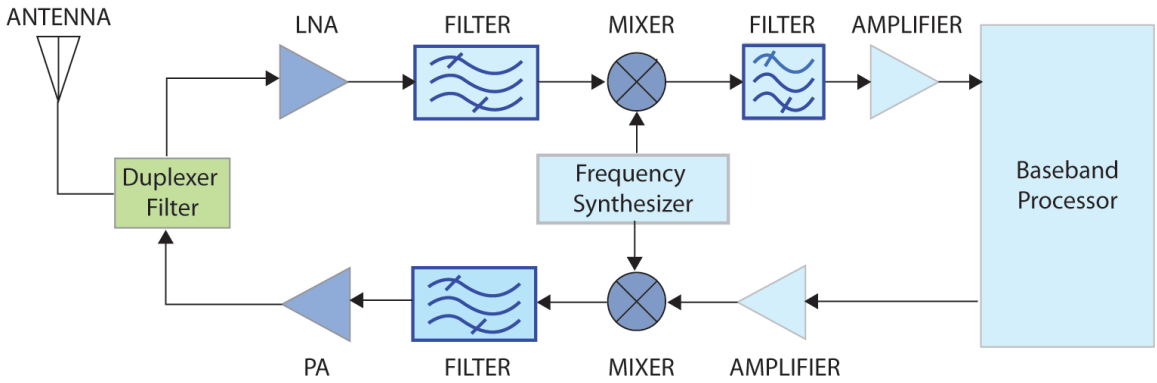

Figure 1 – Simplified RF Transceiver