Analog Switch Applications in a MultiMode Cell Phone

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Summary: Currently a few semiconductor vendors are providing chipsets for multimode cellular phones. The cell phone hardware solution is solved with a few ASIC chips. Generally it is a three-chip solution. Frequently several signal switching functions are needed to communicate amongst these chips and also with other circuit elements and modules. Because of oversight or lack of space on the silicon or partitioning, it is not possible to integrate the functions in the ASIC or in the chipset. In this situation, external small geometry switches are used.

To perform switching functions in cellular phones, a high quality low-loss analog signal switching device can be used. These switches can be used to select different functions of the phone or activate/deactivate circuit elements.

A few vendors are providing chipsets for digital phones. In a digital GSM-type phone, the receiver and transmitter are locked at the required frequencies (900 MHz, 1800 MHz and 1900 MHz) through a PLL. In general the GSM phone consists of three main blocks (see Figure 1) that are normally performed in an ASIC.

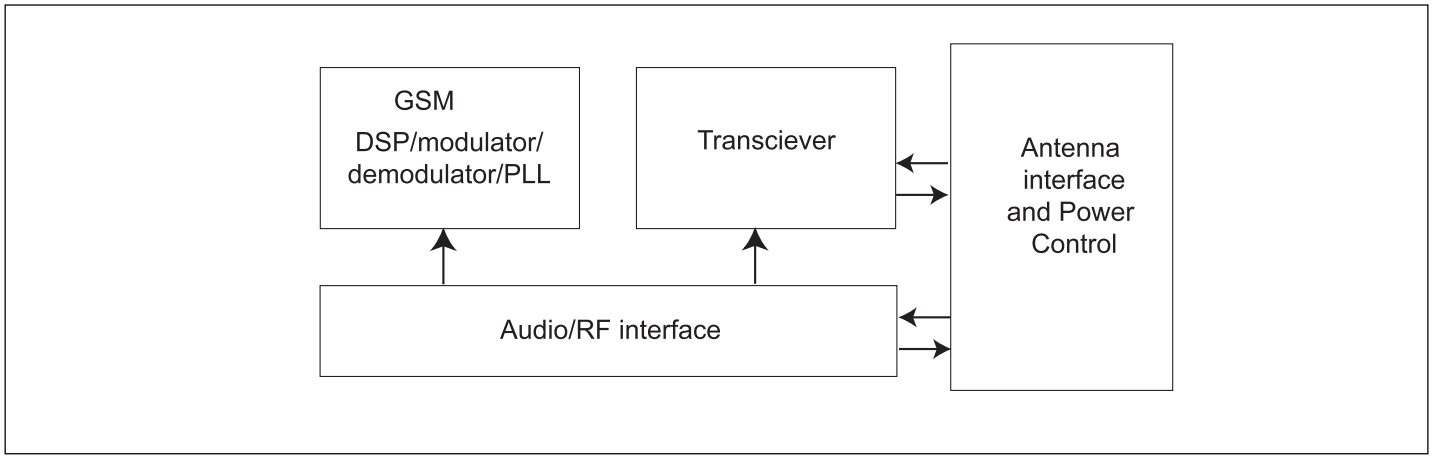

Figure 1. GSM Phone Block Diagram

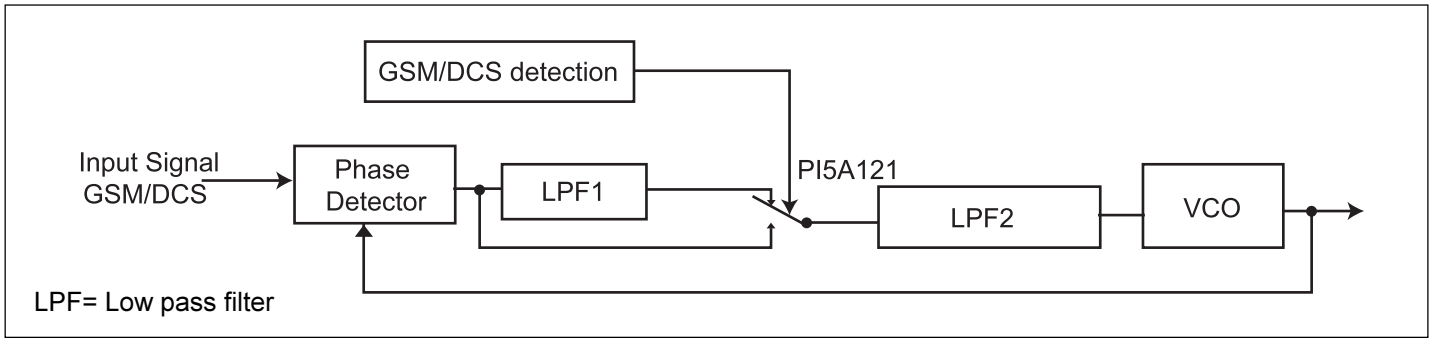

Figure 2. Typical PLL Set Up

The PLL is the heart of the system for providing timing information. The block diagram (see Figure 2) is a typical PLL set up. In a multimode phone, different low-pass filters are required. In GSM and DCS (2XGSM) phones, frequencies are filtered through a low-pass filter. The method of modulation used in GSM is called Gaussian Minimum Shift Keying (GMSK). The PLL is digital. In GMSK there is a time slot by which the PLL has to be completed.

In a multimode phone, typically only one PLL is used and different low-pass filters are switched in for different frequencies (i.e. 900 MHz, 1800 MHz, 1900 MHz). The LPF smooths the output of the phase detector (PD) and determines the dynamic performance of the loop that includes general servo loop issues such as capture and lock ranges, noise suppression bandwidth, and transient response. The bandwidth of the LPF is crucial to the dynamic and noise filtering performance of the loop.

Multiple filters can be switched in and out using a high-performance analog switch like Pericom's PI5A121T. This switch has a very low channel resistance when the switch is ON, and a rail-to-rail dynamic range. The GSM chipset can automatically detect the presence of the proper operation mode and provides the control signal to the switch to add in capacitors and resistors to change the bandwidth of the filter.

The analog switch used in this application is Pericom Semiconductor's PI5A121T, a Single-Pole, Single-Throw Switch. Some of the important characteristics of this switch are low on resistance (6 Ohm typical), ON resistance flatness (3 Ohms) across the operating voltage, fast turn on, and small package (SOT23). For more switch characteristics details, please visit Pericom's website at www.pericom.com or call 1 (800) 435-2336.