A 1.5V 10MHz BiCMOS Quasi-Digital Vector Modulator for Wireless Communication IC

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Abstract

This paper presents a 1.5V 10MHz quasi-digital vector modulator using low-voltage BiCMOS dynamic logic circuit and digital-to-analog converter for wireless communication IC. Based on a $1\mu m$ BiCMOS technology, the 1.5V quasi-digital vector modulator shows a total harmonic distortion of 20.7% at a carrier frequency of 10MHz.

1 Introduction

Vector modulator is an important component in a wireless communication system using spread spectrum techniques. In order to realize portable wireless communication system, a vector modulator using a low supply voltage is important. In this paper, a 1.5V 10MHz quasi-digital vector modulator using a low-voltage BiCMOS dynamic logic circuit [1][2] and a BiCMOS digital-to-analog converter for wireless communication IC is reported.

2 The 1.5V BiCMOS Quasi-Digital Vector Modulator

As shown in Fig. 1, the 10MHz vector modulator is composed of a digital portion and an output stage. In the digital portion, modulation is accomplished by multiplying the two input base-band signals by a 10MHz digital carrier. Then, a 4-bit digital ouptut is obtained by summing the two modulated digital signals. At the output stage, the intermediate digital signal is converted to a 5-level analog output. In order to realize the 10MHz vector modulator using 1.5V power supply, 1.5V BiCMOS circuit techniques

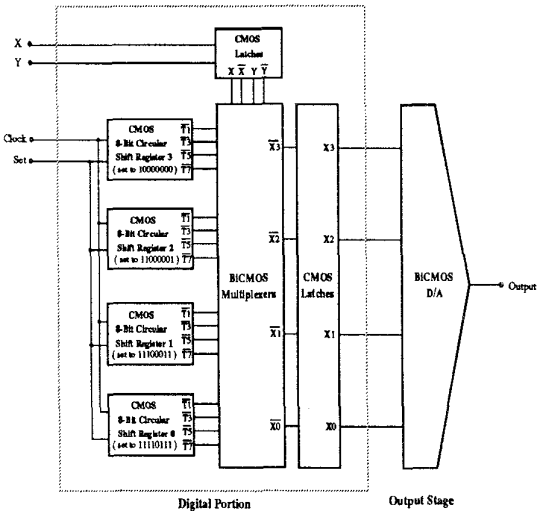

Figure 1: Block Diagram of the vector modulator.

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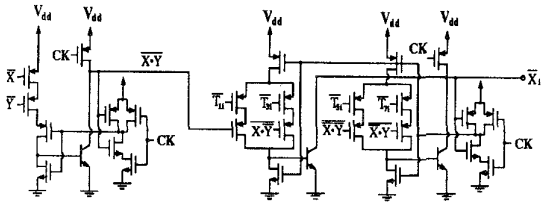

Figure 2: The 1.5V BiCMOS dynamic multiplexer circuit.

have been applied. In the digital portion, there are four 8-bit circular shift registers and 6 latches using CMOS dynamic circuits.

In addition, four 1.5V BiCMOS dynamic multiplexers as shown in Fig. 2 have been used to speed up the circuit. Fig. 3 shows the output stage circuit using a 5-level digital-to-analog converter. As shown in the figure, digital-to-analog conversion is accomplished by the current-mirror techniques with a load resistor realized by the floating voltage-controlled techniques [3].

In order to show the performance, a test BiCMOS vector modulator chip, based on $1\mu m$ BiCMOS technology, has been designed. The die area of the chip is $938\mu m \times 1033\mu m$. Fig. 4 shows the total harmonic distortion vs. power supply voltage of the BiCMOS vector modulator. As shown in the figure, the 1.5V quasi-digital vector modulator shows a total harmonic distortion of 20.7% at a carrier frequency of 10MHz.

References

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[3] M. Banu and Y. Tsividis, "Floating Voltage-Controlled Resistors in CMOS Technology," *Electronics Letters*, Vol. 18, No. 15, pp. 678-679, July 1982

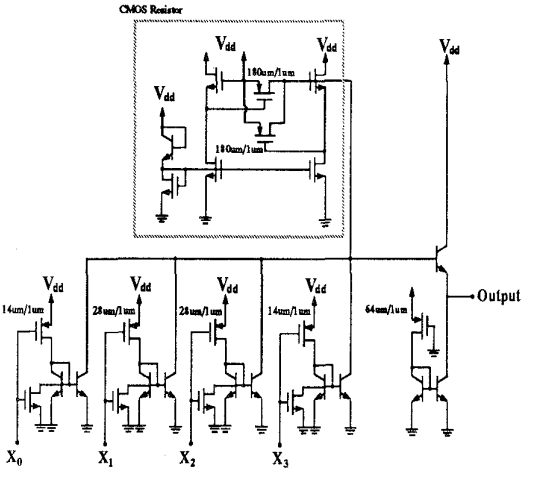

Figure 3: The 1.5V BiCMOS output stage.

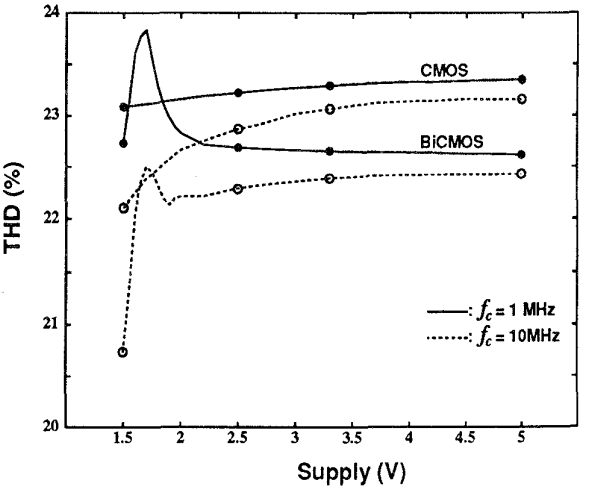

Figure 4: The total harmonic distortion vs. power supply voltage of the vector modulator.