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Shift Register Design Using Four and Eight Bit Flip-Flop

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Abstract—

A novel concept of multi bit flip-flops has been proved to be an effective way in processing multiple bits simultaneously .In this paper we propose a way of using multi bit flip-flop technique in designing various digital circuits. By sharing the inverters in the flip-flops, the total number of inverters can be reduced in a multi-bit flip-flop. So, here, we have designed a shift register which is an important memory element in digital systems, using 4-bit flip flop & 8-bit flip flop. Experimental results reveal that our approach is very efficient, which can be effortlessly incorporated in modern vlsi circuit designs.

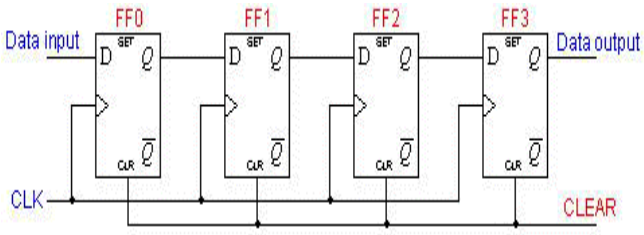
I. INTRODUCTION

Today, the necessity of portable systems and simultaneously improvement in battery performance are the major factors in VLSI design parameters .Communication devices and portable multimedia have experienced explosive growth recently. Since, it is one of the crucial factors in chip based design, the need for longer battery life is responsible for the success of the electronic products. And for the multimedia and wireless communication applications, low-power circuit design has become very important. In many such products, multi-bit flip-flops and delay buffers make up a significant portion of their circuits [1]. One of the basic and important building circuit for VLSI chips is flip flop. If we replace smaller flip-flops by larger multi-bit flip-flops, device variations in the corresponding circuit can be effectively reduced. As CMOS technology progresses, the driving capability of an inverter-based clock buffer increases significantly [2]. Multi bit flip flop is a cluster of several single-bit flip-flops i.e. they share the drive strength. So, using multi-bit flip-flops not only can reduce clock circuitry but also the total numbers of flip-flops required get reduced effectively.

THE CONCEPT OF MULTI BIT FLIP FLOP

In the proposed concept, we involved a method of merging two 1-bit flip-flops (figure 2a) into one 2-bit flip-flop. Each flip-flop contains two inverters to generate opposite-phase clock signals. Since with the advances of process technology to 65 □□ and beyond, even a minimum sized inverter can still drive multiple flip-flops. Hence, the number of inverters will significantly get reduced by replacing several 1-bit flip-flops with one multi-bit flip-flop (MBFF).

four-bit shift register



A basic four-bit shift register can be constructed using four D flip-flops, as shown in Figure 2.1.

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The operation of the circuit is as follows. ?? The register is first cleared, forcing all four outputs to zero. ?? The input data is then applied sequentially to the D input of the first flip-flop on the left (FF0). ?? During each clock pulse, one bit is transmitted from left to right. ?? Assume a data word to be 1001. ?? The least significant bit of the data has to be shifted through the register from FF0 to FF3. In order to get the data out of the register, they must be shifted out serially. This can be done destructively or non-destructively. For destructive readout, the original data is lost and at the end of the read cycle, all flip-flops are reset to zero.

A CONVENTIONAL SHIFT REGISTER

The most important memory element is the flip flop, which is made up of an assembly of logic gates. Storage of data is the primary function of a flip flop. These data are stored in group of flip flops called registers.

A. Shift register

A shift register is a group of flip flops arranged in a way that involves the transfer of data for every clock pulse. It is a memory circuit that is an important building block in data processing systems, digital computers, and calculating devices. Here the logic level that is currently stored in preceding flip flop is transferred to the input of the succeeding flip flop. The clock inputs are used to perform the transfer operation.

B. *Data storage*

Data can be stored in a serial or in a parallel way in the shift register. In parallel transfer, all the information is transferred simultaneously upon the occurrence of a single transfer command. In serial transfer, the complete transfer of bits of information requires as many clock pulses as are the number of bits.

C. Data translation

In converters shift registers are employed for translating serial data to parallel data, or vice-versa. Also a shift register is found useful in a pulse extender in digital systems and delay circuits.

IMPLEMENTATION USING MULTI BIT FLIP FLOP

In this section, we will introduce how to design a shift register using multi-bit flip-flop. Since we want to replace the single bit flip-flops with multi-bit flip-flop that must have identical clock conditions and similar type of logic levels to set or reset the flip flops. The concept of multi bit flip flop has been employed in designing a shift register which is an important building block in digital systems. In our design, we have used the 2-bit D flip flops introduced earlier. The advantage of using this concept is the simultaneous processing of bits being achieved by the proposed circuit. Using four 4-bit D flip flop we succeeded in processing 16 bits in our design.

CONCLUSION

The concept of 4-bit/8-bit D flip flop has been implemented successfully in designing a shift register in an unconventional way. It is capable of handling two bits concurrently. The concept is further extended and we have used 4-bit D flip flop which is capable of handling 4-bits simultaneously. The results observed after simulations are the same as are for conventional shift register. We used Xilinx and cadence for implementing our design. The requirement for constituting elements can be brought down considerably. The schematic and waveforms are given in the paper. In future it can be tried to use

this basic concept of multi bit flip flop in designing other sequential circuits.

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