Digital Control Selects The Number of Analog Cycles and Burst Frequency

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Introduction

Repetitive pulse bursts are required for impulse testing and for burst data transmission schemes. Impulse testing subjects the device under test to a unit impulse or doublet, and the response waveform is analyzed to determine the circuit's performance. Burst data transmission systems send out repetitive pulse bursts. The pulse burst repetition rate is decoded by filtering to select between different transmitting systems, and the number of pulses in a burst form a command. It is easy to design pulse burst systems with digital circuits, but the results are much better when analog circuits are used because triangular and sinewaves fit the theory much better. Also, triangular and sinewaves incur much less ringing and overshoot during transmission than digital waveforms do.

A photo of the transmitted signal and the continuous sinewave from which it is derived is shown in Figure 1. The HA4600 buffer has an enable/disable feature, so it will pass or reject the input waveform depending of the state of the enable pin (see Figure 2). Now the trick is to control the enable input to the HA4600 so that it passes the number of input cycles required to form the burst count, while it rejects the number of input cycles required to form the correct repetition frequency.

The input signal is also present at the input to the HFA3046 transistor array which has been configured as a high speed, high gain comparator. The comparator squares up the input signal and applies it to the inputs of the two counters, X and Y. The X counter controls the buffer enable, and it determines how many cycles of the input waveform get passed to the output. The four switches S_{X0} through S_{X3} are binary coded, thus if two switches S_{X0} = 1cycle and S_{X1} = 2 cycles are closed, three cycles of the input sinewave will be passed to the output.

The input signal is also connected to the Y counter which controls the repetition rate by determining the off period between pulse bursts. The four switches S_{Y0} through S_{Y3} are binary coded. When all of these switches are closed the off period will be 16 times the period of the input waveform. With the X and Y counters are set as described above the repetition rate is the reciprocal of (16+3) times the period of the incoming waveform. If a longer repetition rate is desired a flip flop or another counter can be added in series with the output of the Y counter to extend the off time.

The specifications for the comparator are very demanding including the ability to function with low input voltages, very low storage delays, fast switching speeds, and no reflections back to the input. No off-the-shelf comparator met these requirements so the HFA3046 was configured as a comparator. R_6, R_7, and R_8 bias the long tailed transistor at 10mA which is the optimum point for speed. R_5 and R_6 are small enough to discharge quickly thus preventing saturation. The HA4600 was chosen for the enable amplifier because it has a very high bandwidth (480MHz), and it is inexpensive. If gain is required a HA5020 or HFA1145 enable op amp can be used instead of the HA4600.

Configured as shown the circuit will handle MHz input signals with little degradation. The limit on frequency response is the speed of the logic and the comparator delay time. The comparator delay time can be eliminated by one-shoting out the delay.

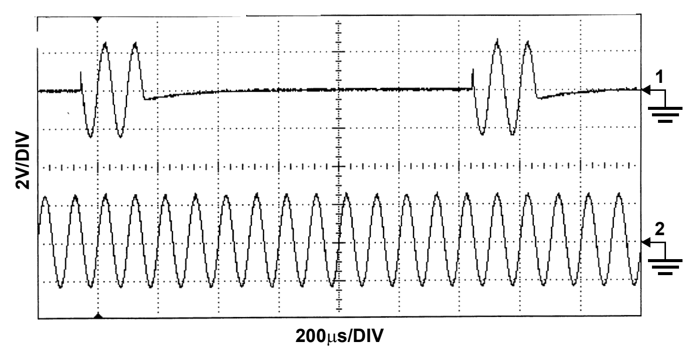

FIGURE 1. TRANSMITTED DOUBLET AND CONTINUOUS WAVEFORM

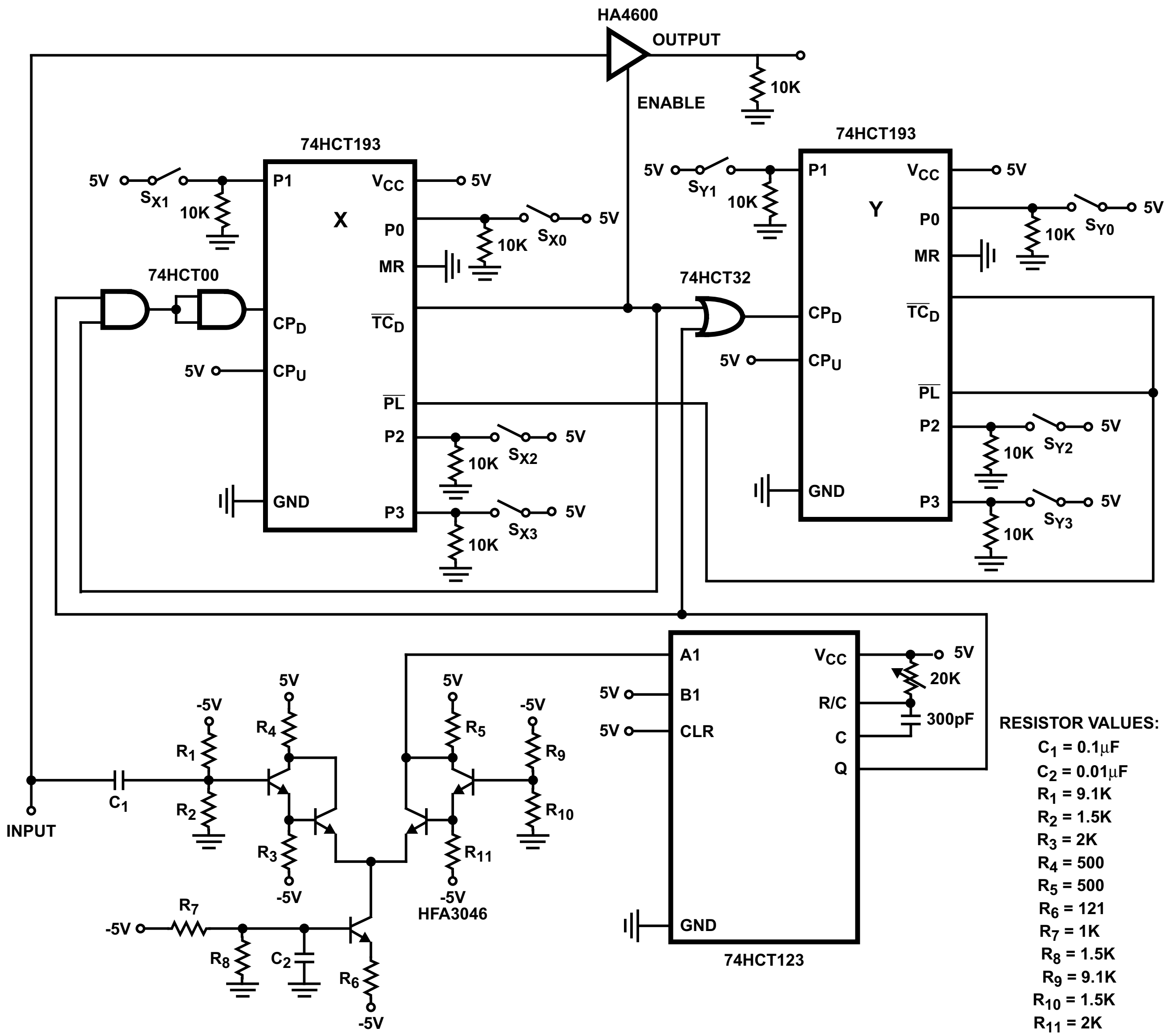

FIGURE 2. TRANSMITTED DOUBLET AND CONTINUOUS WAVEFORM

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