Tech Brief 32
Frequency Doubler using Delay Lines

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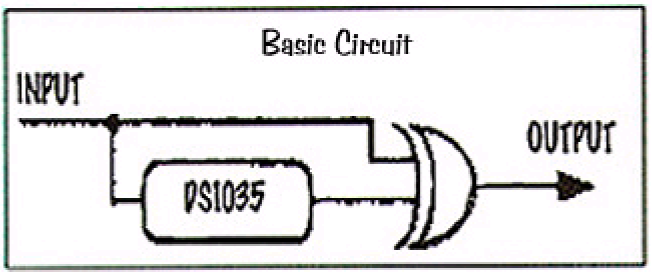
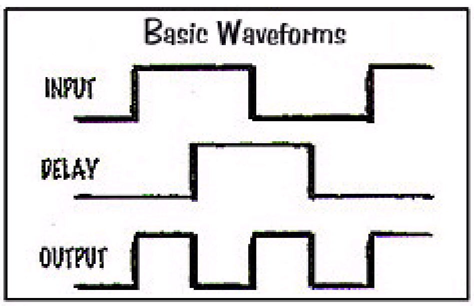
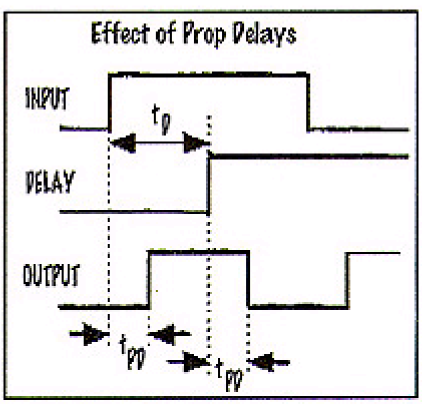
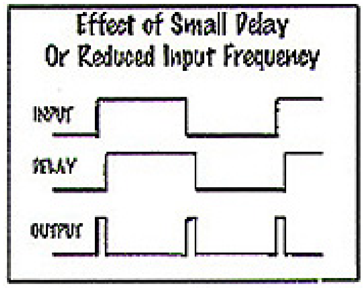
If a clock signal is delayed by one-quarter period, it can be gated with the original waveform to produce a novel application: frequency-doubled output.

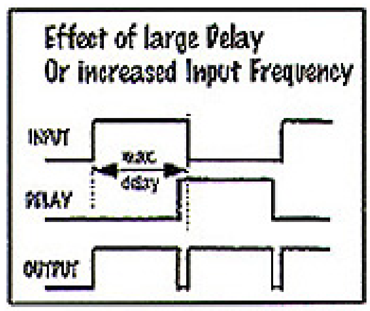






This time, the XOR propagation delay (t_{PD}) will impact only the relative skew from input to output and will not otherwise distort the waveform. Obviously, the optimum delay time for this application is one-quarter of the input period. Deviation from this "ideal" value, or altering the input frequency, will cause a change in the output duty cycle but will not change the frequency. The minimum usable delay (lowest usable input frequency) is dependent only on the minimum acceptable output pulse width or duty cycle. The maximum usable delay (highest input frequency) is constrained by the minimum input pulse width specification of the delay line.


Effect of Small Delay
Or Reduced Input Frequency
INPUT
DELAY
OUTPUT


Effect of large Delay
Or increased Input Frequency
INPUT
max delay
DELAY
OUTPUT