MEASUREMENT TIPS
Volume 2, Number 2

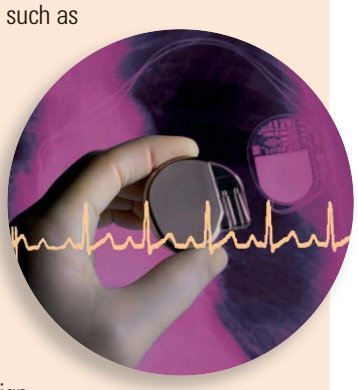
Generating Narrow Pulses with a Function Generator

Testing basic digital signals, such as triggers, clock signals, and logic control, doesn't always require the performance of a dedicated pulse generator. It is often easier to use the function generator you have at hand, which also saves the time and headache of searching for another piece of test equipment to use. When you need to characterize low-frequency digital devices such as microcontrollers, you can use function generators to produce the digital signals and create the narrow pulses these tests require.

SIMULATE SIGNALS FOR TESTING DESIGNS

Snapshot: Designing Pacemakers

Pacemakers are used to control arrhythmias by producing an electrical pulse that stimulates the heart muscle and encourages the heart to beat at a normal rate. The designer of a pacemaker needed to allow for many adjustments, including the amplitude, width, and rate of the stimulating pulse. Widening the pulse width improves the ability of the pacemaker to capture the heart beat signal and maintain synchronization, while narrowing the pulse width improves the battery life and reduces the side effects of electrical signals, such as twitching of the pectoral muscles or interrupting the normal breathing pattern by stimulating the diaphragm. The pacemaker produces a narrow pulse signal of approximately 71 beats per minute and a pulse width around 0.5 msec. The designer used a function generator to simulate the narrow pulses and vary the parameters to test the effects these adjustments had on the rest of the design.



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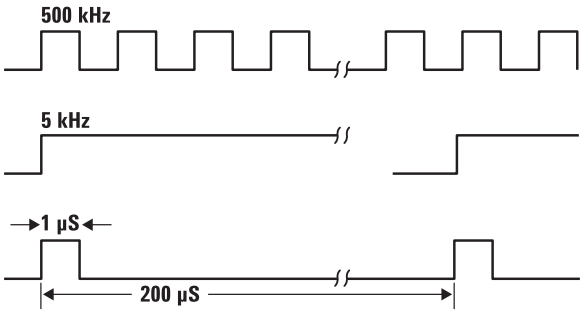
Multiple ways to generate pulses

You can use a variety of methods to create narrow pulses (or low duty cycle pulses). Many of the newer function generators, such as the Agilent 33220A and 33250A function/arbitrary waveform generators, have built-in pulse capability to give you the convenience of generating basic pulses.

Another method is to vary the duty cycle of a square wave, typically between 20 and 80 percent on most function generators. The technique of using arbitrary waveforms to generate pulses is not used as often, but it allows additional customization, such as creating Gaussian edges, exponential edges, and adding overshoot or undershoot.

Step-by-step: narrower pulses

If you want even narrower pulses, you can use the burst mode capability of a function generator to extend the interval between pulses. You start by setting up a square wave or an arbitrary waveform to correspond to the desired pulse width. For example, if you need a 1 µs pulse width, you could use a 50% duty cycle square wave at 500 kHz (2 µs period). The 33220A and 33250A function/arbitrary waveform generators allow you to adjust either frequency or period by toggling between the values.



Next, you turn on the burst mode and set the number of cycles to 1. When pressing the BURST key on the front panel of the Agilent 33220A and 33250A, this is the default burst setting.

Finally, set the burst rate to the desired period. For a 0.5% duty cycle waveform using the 1 µs pulse from above, set the burst period to 200 µs. With these three steps, you are now up and running with your narrow pulse.

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- You can also adjust the pulse width by changing the duty cycle. Using a 25% duty cycle in the example above will generate a pulse width of 0.5 µs.
- For a negative pulse, you can use the same procedure as above, then use the output settings to invert the waveform.
- When you create pulses using arbitrary waveforms, use Agilent IntuiLink Waveform Editor. This stand-alone application allows you modify or design waveforms from scratch or by including the add-in for creating pulses. Once you create the waveform, you can download it to the 33220A or 33250A function/arbitrary waveform generator.

Summary

You can use general-purpose function generators to create pulses for many low-frequency digital applications. We have demonstrated the use of burst mode and described how this technique will allow you to generate low duty-cycle pulses from a general-purpose function generator rather than using a dedicated pulse generator.

Learn more about the Agilent 33220A function generator (TOP) at **www.agilent.com/find/33220A**

Learn more about the Agilent 33250A function generator (BOTTOM) at **www.agilent.com/find/33250A**

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