



## High-Voltage, Asymmetric-Waveform Generator

This circuit would be optimized for a capacitive load.

NASA's Jet Propulsion Laboratory, Pasadena, California

The shapes of waveforms generated by commercially available analytical separation devices, such as some types of mass spectrometers and differential mobility spectrometers are, in general, inadequate and result in resolution degradation in output spectra. A waveform generator was designed that would be able to circumvent these shortcomings. It is capable of generating an asymmetric waveform, having a peak amplitude as large as 2 kV and frequency of several megahertz, which can be applied to a capacitive load. In the original intended application, the capacitive load would consist of the drift plates in a differential-mobility spectrometer. The main advantage to be gained by developing the proposed generator is that the shape of the waveform is made nearly optimum for various analytical devices requiring asymmetric-waveform such as differential-mobility spectrometers. In addition, this waveform generator could easily be adjusted to modify the waveform in accordance with changed operational requirements for differential-mobility spectrometers.

The capacitive nature of the load is an important consideration in the de-

sign of the proposed waveform generator. For example, the design provision for shaping the output waveform is based partly on the principle that (1) the potential ( $V$ ) on a capacitor is given by  $V = q/C$ , where  $C$  is the capacitance

The proposed waveform generator would comprise four functional blocks: a sine-wave generator, a buffer, a voltage shifter, and a high-voltage switch (see Figure 1). The sine-wave generator would include a pair of operational amplifiers in a feedback configura-

tion, the parameters of which would be chosen to obtain a sinusoidal timing signal of the desired frequency. The buffer would introduce a slight delay ( $\approx 20$  ns) but would otherwise leave the fundamental timing signal unchanged. The buffered timing signal would be fed as input to the level shifter. The output of the level shifter would serve as a timing and control signal for the high-voltage switch, causing the switch to alternately be (1) opened, allowing the capacitive load to be charged from a high-voltage DC power supply; then (2) closed to discharge the capacitive load to ground. Hence, the output waveform would closely approximate a series of exponential charging and discharging curves (see Figure 2).

This work was done by Luther W. Beegle, Tuan A. Duong, Vu A. Duong, and Isik Kanik of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-45665

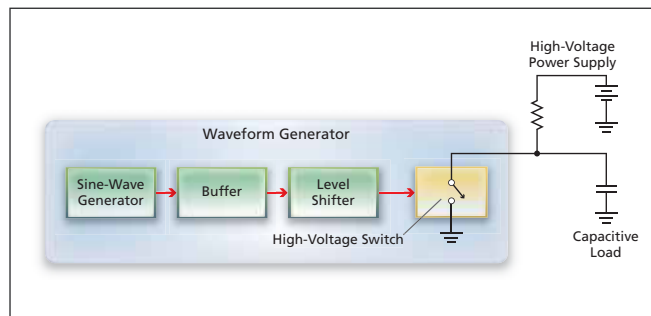


Figure 1. The **Waveform Generator** would cause the capacitive load to be alternately (1) charged from the high-voltage power supply, then (2) discharged to ground.

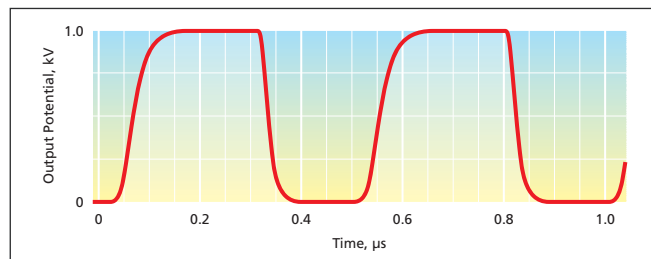


Figure 2. This **Typical Output Waveform** of the proposed waveform generator was simulated, assuming a design supply potential of 1 kV and a design frequency of 2 MHz.

and  $q$  is the charge stored in the capacitor; and, hence (2) the rate of increase or decrease of the potential is similarly proportional to the charging or discharging current.

## Magic-T Junction Using Microstrip/Slotline Transitions

Economical broadband junctions have potential utility in diverse microwave systems.

Goddard Space Flight Center, Greenbelt, Maryland

An improved broadband planar magic-T junction that incorporates microstrip/slotline transitions has been developed. In comparison with a prior broadband magic-T junction incorporating microstrip/slotline transitions,

this junction offers superior broadband performance. In addition, because this junction is geometrically simpler and its performance is less affected by fabrication tolerances, the benefits of the improved design can be

realized at lower fabrication cost. There are potential uses for junctions like this one in commercial microwave communication receivers, radar and polarimeter systems, and industrial microwave instrumentation.