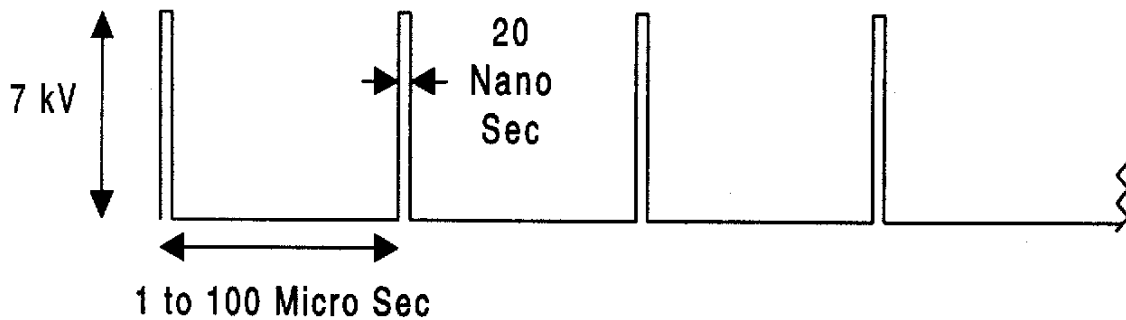


The HVP-540-DPHT Pulser System

The HVP-540-DPHT Pulser System was developed by Quantum Technology, Inc. to meet a specific customer requirement to produce a train of either 2 or 4 HV pulses. It was required to drive a KD*P Pockels cell, such as a model QC-24. The waveform shown in Figure 1 is an example of a representative train of input pulses on the HVP-540-DPHT-4 Pulser. The HVP-540-DPHT-2 Pulser receives two separate triggers which create two pulses separated by the same time. These two pulses are generated by an external source or the DD1 Divider Delay Plugin, if installed.

Quantum Technology's standard high voltage switch is pulsed on for approximately 150 ns (nanosecond), which is the limit for the minimum pulse width obtained with a stacked pair. Refer to Figure 2. The top switch connects the RC load to the high voltage supply; it is fully charged in 150 ns. At the end of the desired pulse width, the bottom switch is closed, discharging the RC load to ground. Full discharge takes less than 150 ns. This technique works well for most applications of 200nsec-1ms pulses, but cannot produce pulses less than 200ns, say 20 ns pulse widths for example.



String of 4 Pulses Repeat with a Period of Approx 1 Sec

Note from Figure 3 that the rise and fall times of the Output Pulse are much less than

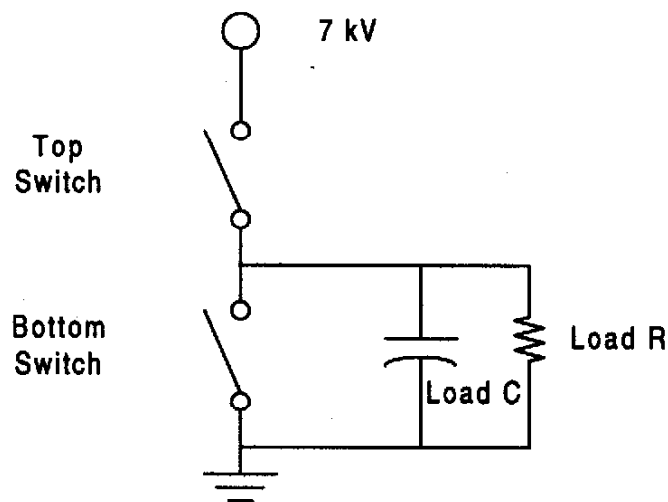


Figure 1 Standard Output Switch Timing

the switch on times. The rise and fall times of 10nsec are typically generated and are limited by the cable and load capacitance.

The top and bottom switch must not be on at the same time as failure could happen. (smoke results). If the bottom switch could be closed instantaneously on the top switch opening, the minimum pulse width would be 150 ns.

The HV Switch arrangement of Figure 4 is used to overcome these limitations. The signal across the Pockels cell is the requirement; both sides of it may float above ground. Figure 5 shows the Left and Right voltage signals used to obtain the required

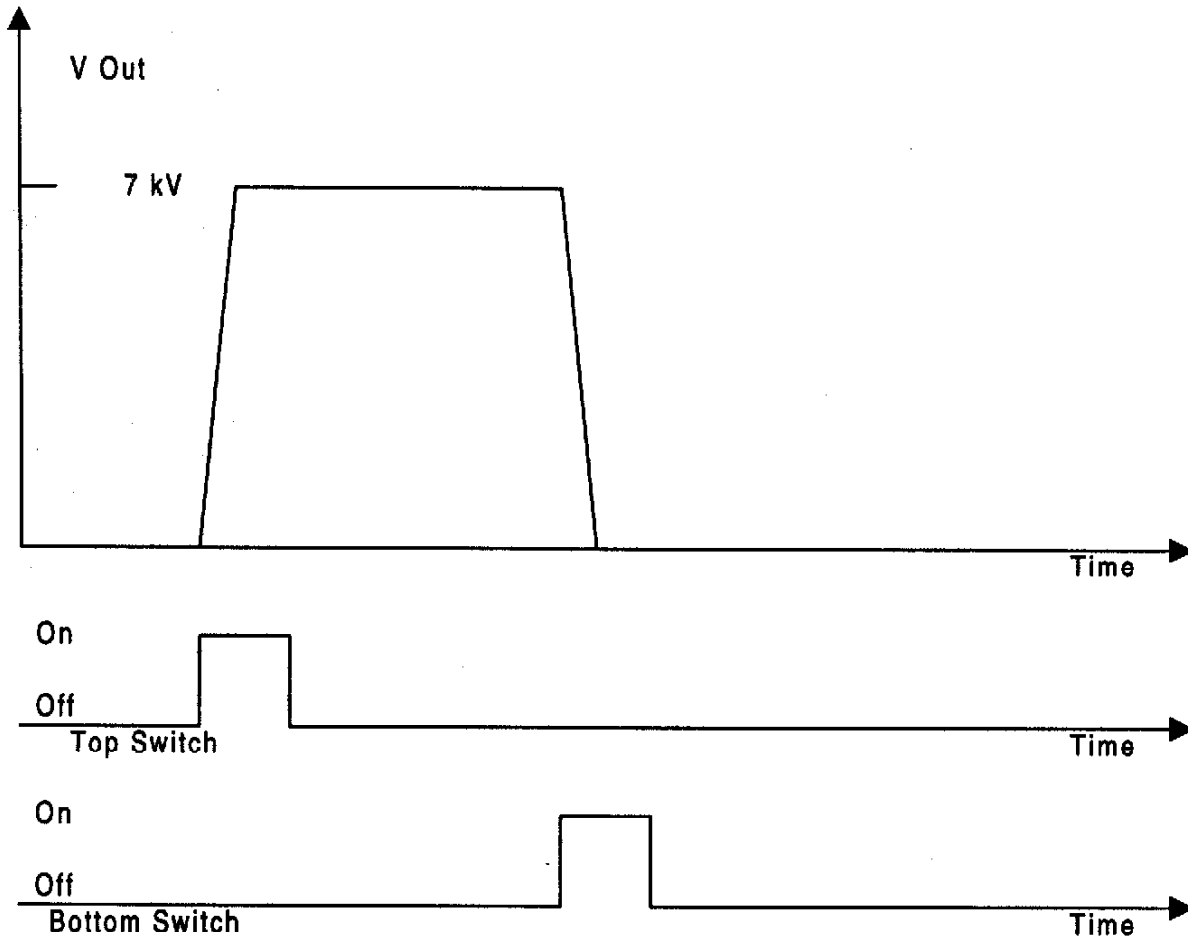


Figure 3. Required Pockels Signal

Pockels cell voltage signal for a HVP-540-DPHT-4 Pulser. For the HVP-540-DPHT-2 Pulser only the first set of waveforms are needed to generate the required first pair of HV pulses.

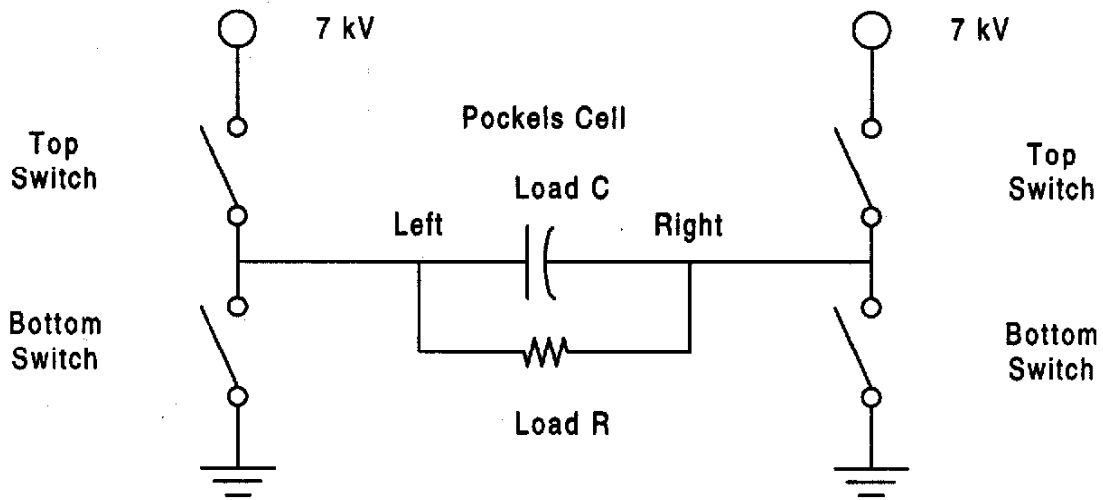


Figure 4 H V Switch

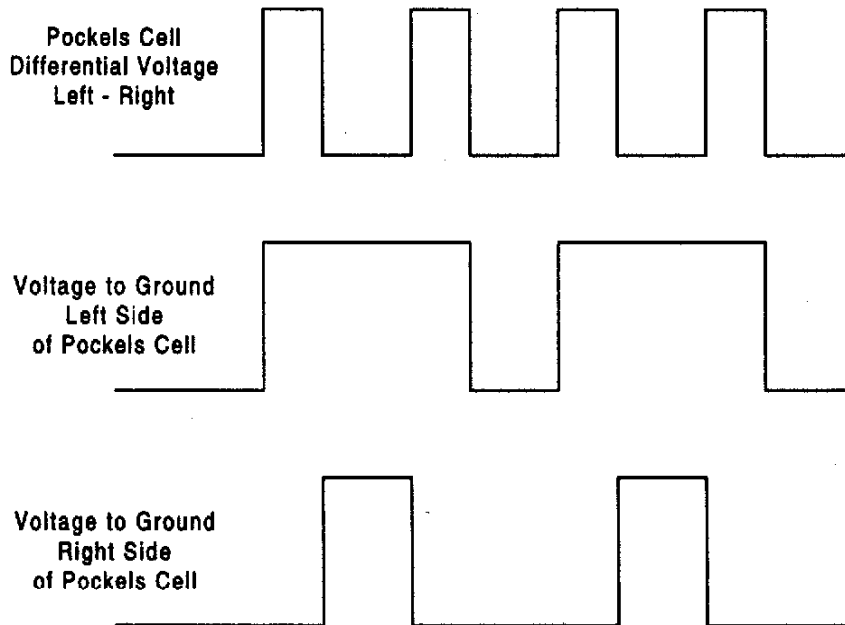


Figure 5 H V Switch Waveforms

The timing of the above signals was altered to emphasize the differential technique used to obtain the required waveform across the Pockels cell.

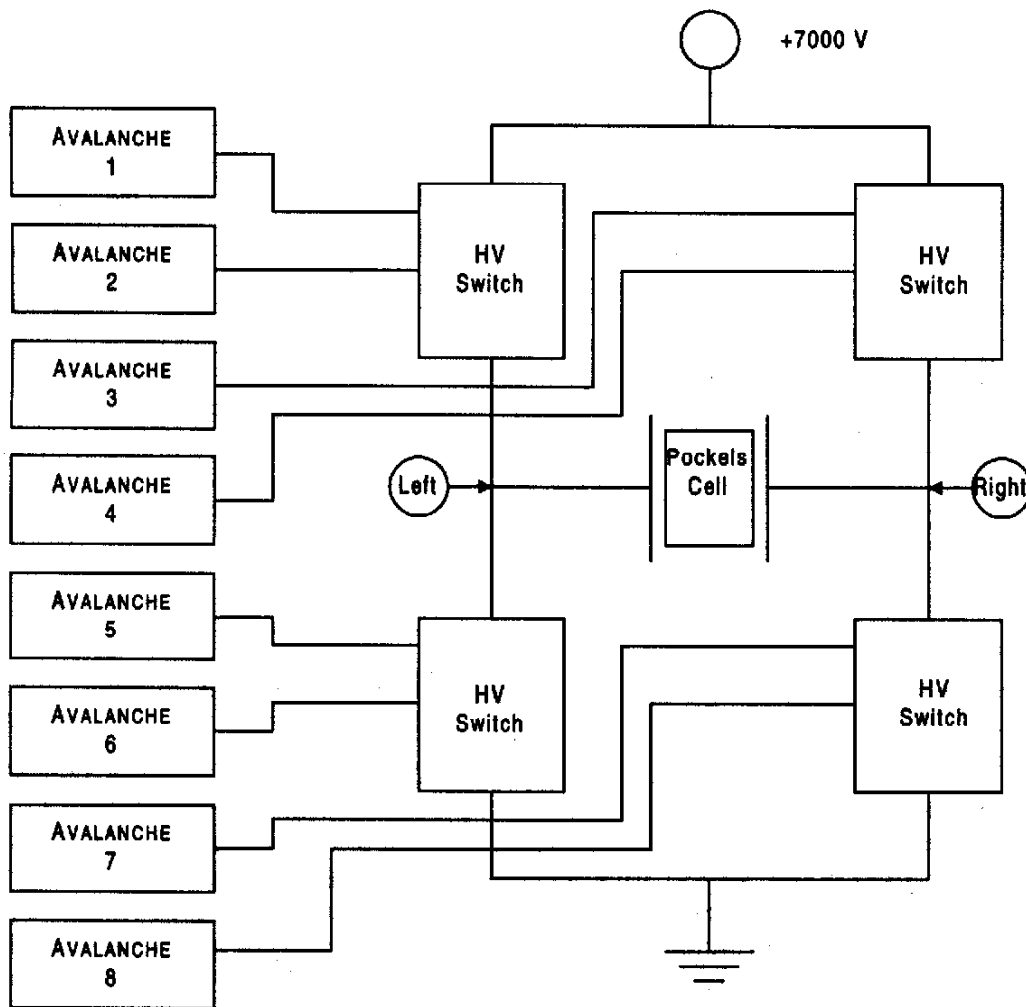
HVP-540-DPHT-4 Pulser Only:

There is a problem developing the waveforms of Figure 5. The avalanche drivers used to drive the high voltage switches have a recovery time of approximately 30 us (micro seconds). This recovery time can be changed a small amount by circuit design , but cannot reach the 1 us minimum required. Quantum Technology's solution was to 'OR' two avalanche drivers onto each high voltage driver.

HVP-540-DPHT Pulser Only:

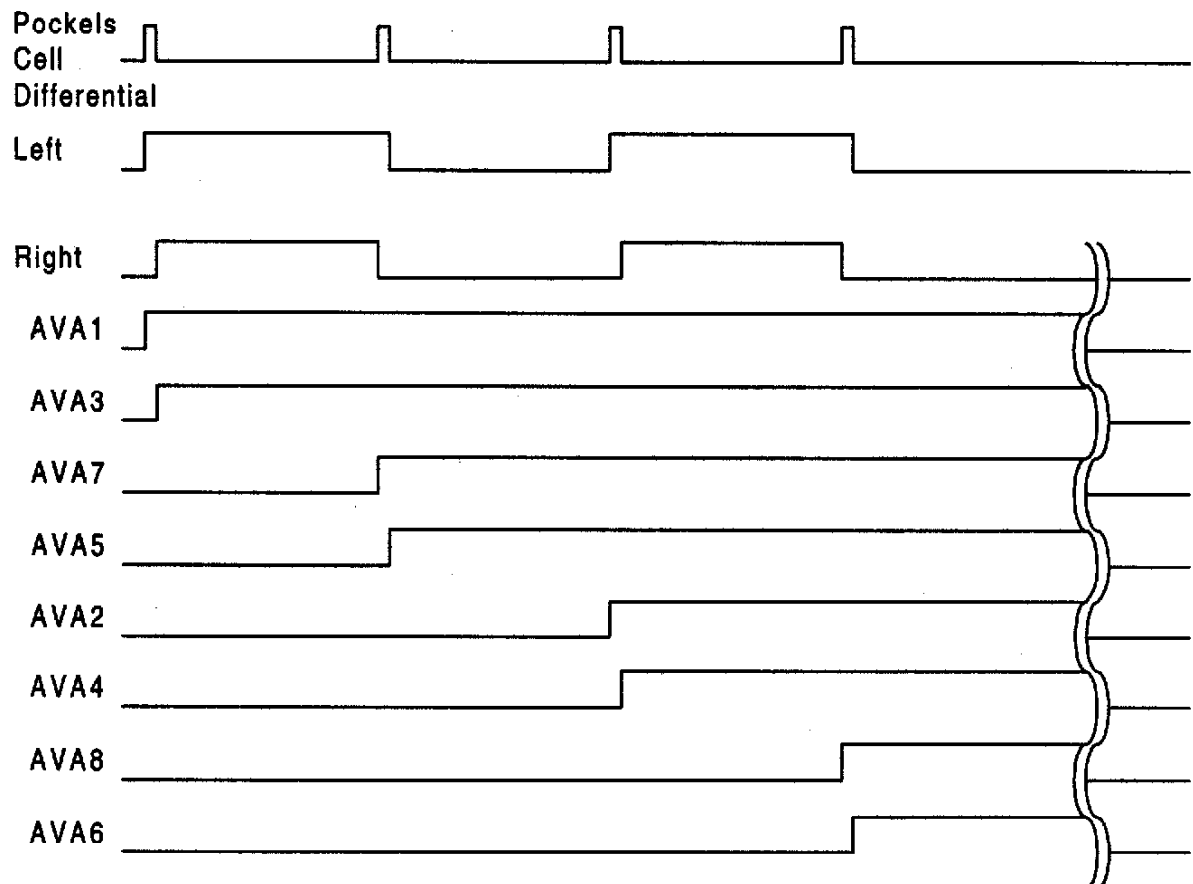
The waveforms applicable for the HVP-540-DPHT-2 Pulser are 1, 3, 7 and 5.

Figure 6 Avalanche and HV Drivers for Required Signal



The waveforms required of each avalanche driver to make the required drive signals is shown in Figure 7.

Figure 7 Required Avalanche Driver Signals



A block diagram of the circuitry required to derive the signals of Figure 7 is shown in Figure 8.

A multiple stage Schmidt trigger inverter is used to produce input signals with different delays. A retriggerable one shot drives an LED indicating the system is triggered if a pulse occurs at least every 2 seconds. Another one shot resets the counters in the PLD (Programmable Logic Device) if no pulse occurs for 125 us; this is to prevent noise pulses from upsetting the count logic. Two one shots are used to detect the leading and trailing edges of the input pulses; their pulse width is small but not used in the system design. The PLD contains a 2 bit counter which it uses to generate the avalanche waveforms. Figure 9 shows the PLD simulation waveforms.

The electronic hardware is constructed in 3 chassis': Power Supply/Logic and 2 identical Pulse Output Units. Identical cables connect the Pulse Output Units to the

Power Supply/Logic Unit. The output connectors for these cables are interchangeable. The Pulse Output Units drive the Pockels Cell.

For the HVP-540-DPHT-4 Pulser, the Power Supply/Logic is a model PS-24-9003-DPHT-4 and contains the necessary supply and logic.

For the HVP-540-DPHT-4 Pulser, the Power Supply/Logic is a model HVPS-9003 with DD1/PC2 option and contains the necessary supply and logic. The section on PLD logic does not apply except of the requisite timing signals AVA1, AVA3, AVA7 and AVA5 signals.

Figure 8 Logic Section Block Diagram

