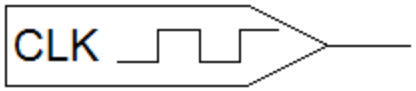
Square Wave Sources: Digclock and Vpulse

Directions given for PSpice Schematics

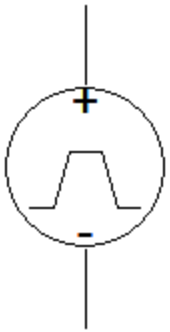
Comparison of Sources

Digclock



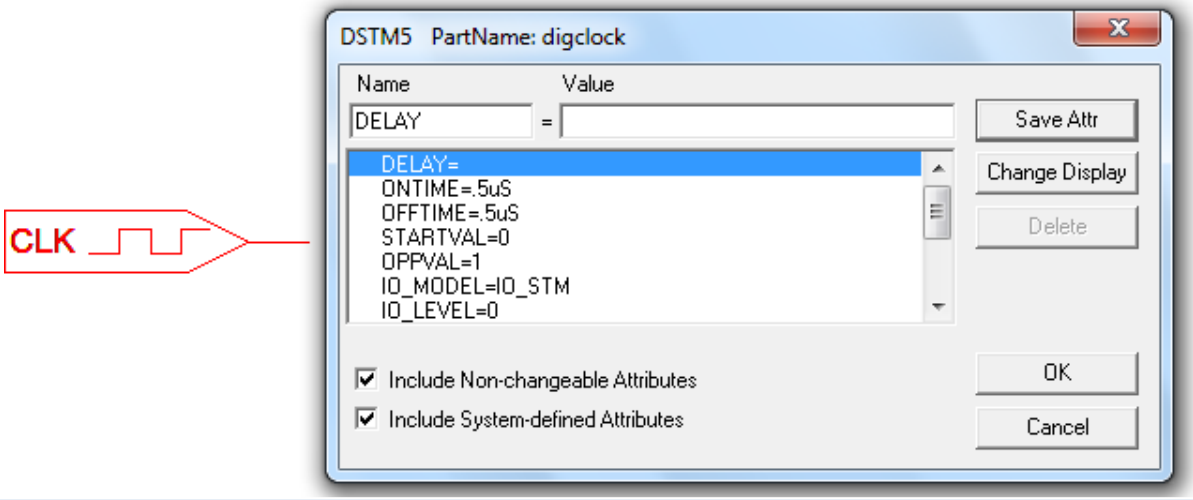
- Voltage levels are 0V and 5V for logic levels “0” and “1”
  - Initial change in voltages can be from 0V to 5V or from 5V to 0V
  - Voltage changes instantaneously
  - Time delay can be set before pulses begin

Vpulse



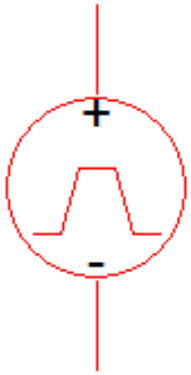
- Two arbitrary voltage levels
  - Can include a ramp as the source changes between voltage levels
  - Can be set for a single or repeating pulse
  - Time delay can be set before pulse(s) begin
  - DC and AC voltages sources are integrated in part for DC Sweep and AC Sweep simulations.

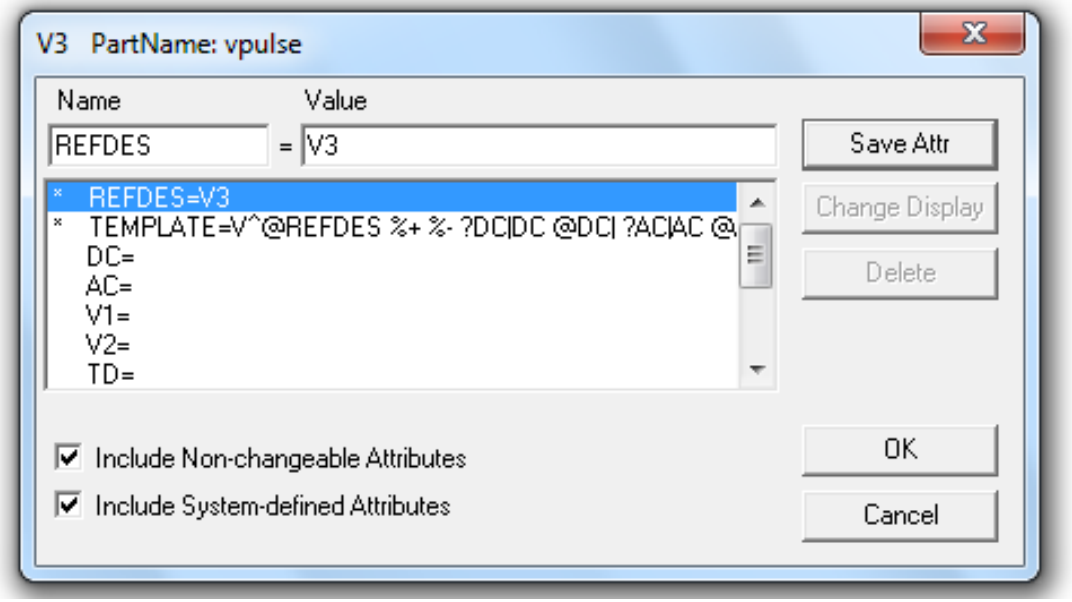
Setting the Attributes of Digclock



Attribute	Description
DELAY	The time delay before the pulses are started.
ONTIME	The length of time that the pulse is at the voltage set by OPPVAL
OFFTIME	The length of time that the pulse is at the voltage set by STARTVAL
STARTVAL	The voltage that will be outputted at time = 0s by Digclock. The values used are “0” for 0V and “1” for 5V.
OPPVAL	The voltage that will be outputted by Digclock when either the DELAY has been completed or the first OFFTIME has been completed if no DELAY has been set. The values used are “0” for 0V and “1” for 5V and should be the opposite logic value to what was entered for STARTVAL.

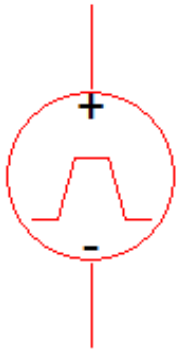
Setting the Attributes of Vpulse

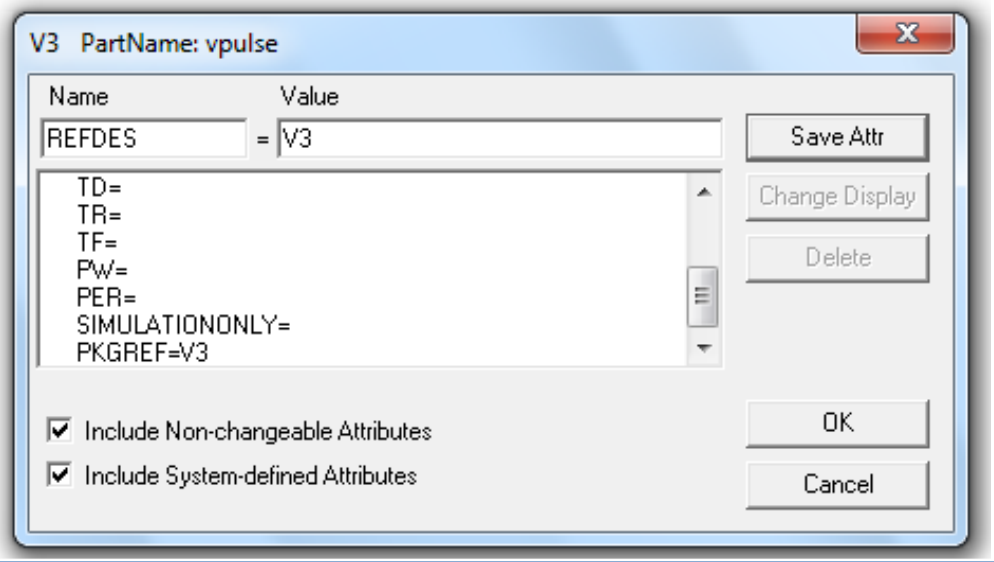




Attribute	Description
DC	Value that will be used when calculating the bias point and allows Vpulse to be used as a DC source in DC Sweep. It does not add a DC offset to the pulse train
AC	Value that will be used when performing a AC Sweep using Vpulse as the voltage source
V1	The first voltage level of the pulse
V2	The voltage level that the pulse changes to, can be larger or smaller than 1V

Setting the Attributes of Vpulse (con't)



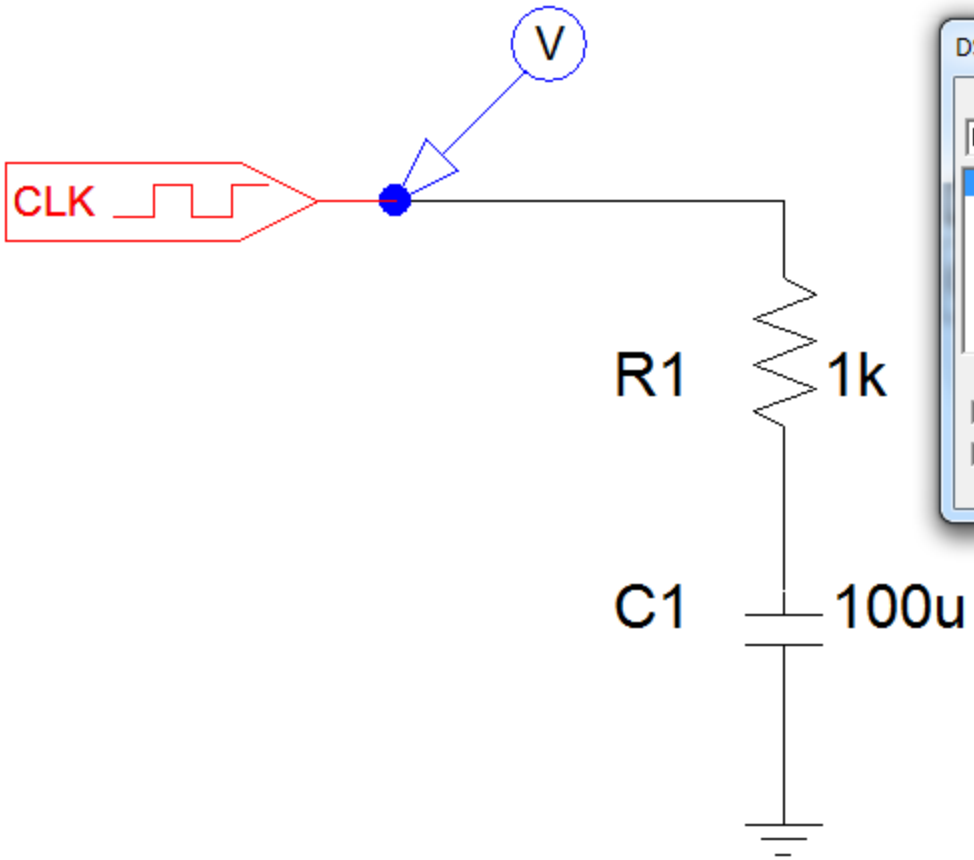


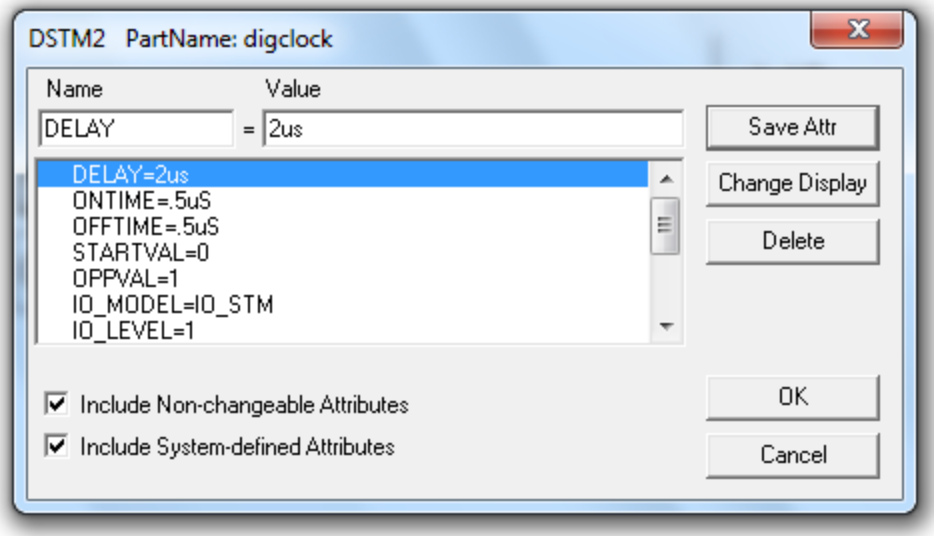
Attribute	Description
TD	The time delay before the pulse (or pulses) is started
TR	The length of time that it takes to ramp the voltage of the pulse from V1 to V2. This can be 0 seconds
TR	The length of time that it takes to ramp the voltage of the pulse from V2 to back down to V1. This can be 0 seconds
PW	The length of time that the output voltage of Vpulse is equal to V2
PER	The length of time of the period of a continuous output of pulses. If this attribute is left unchanged (blank), only one pulse will be outputted by Vpulse

Examples

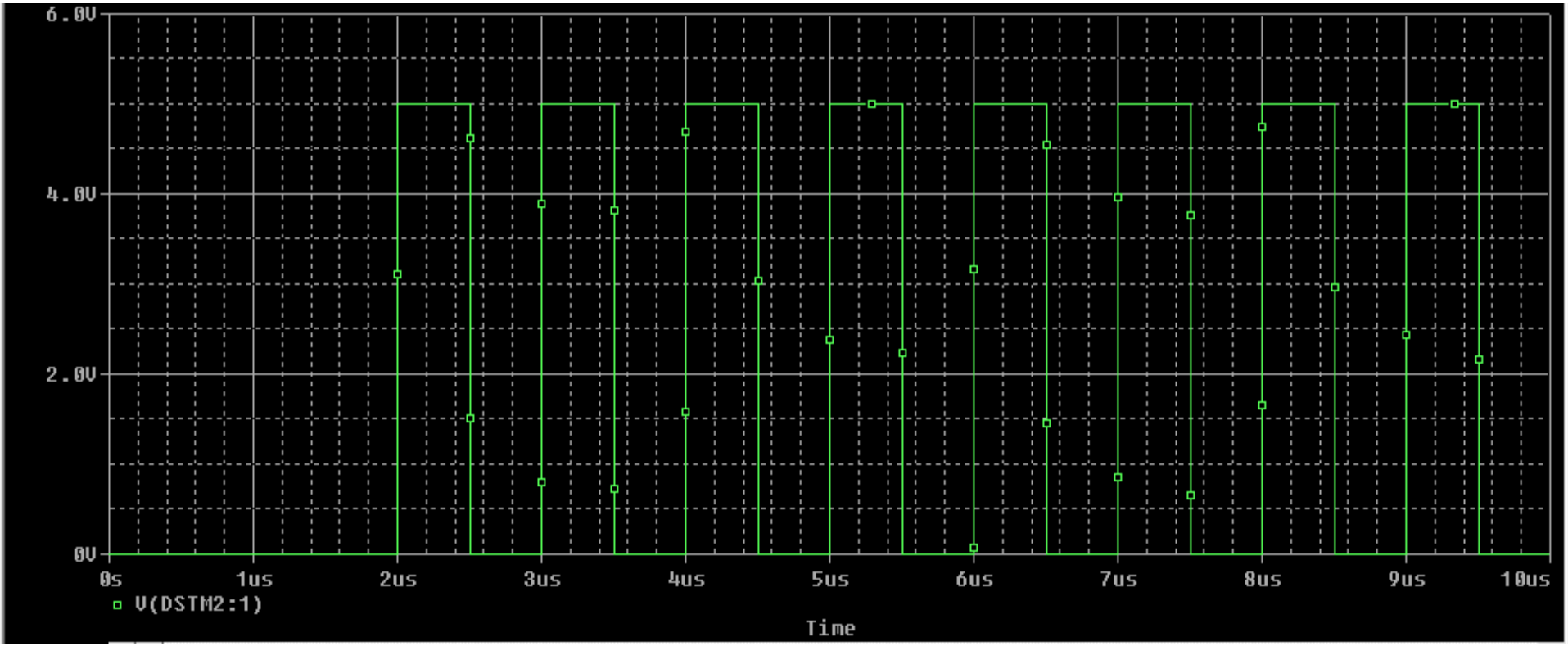
Digclock

The continuous set of pulses do not start until time = 2µs (DELAY = 2us) . The initial voltage is 0V (STARTVAL = 0). Once the pulses start, the pulse length at 0V is 0.5µs (OFFTIME = 0.5us) and the pulse length at 5V is 0.5 µs (ONTIME = 0.5us).



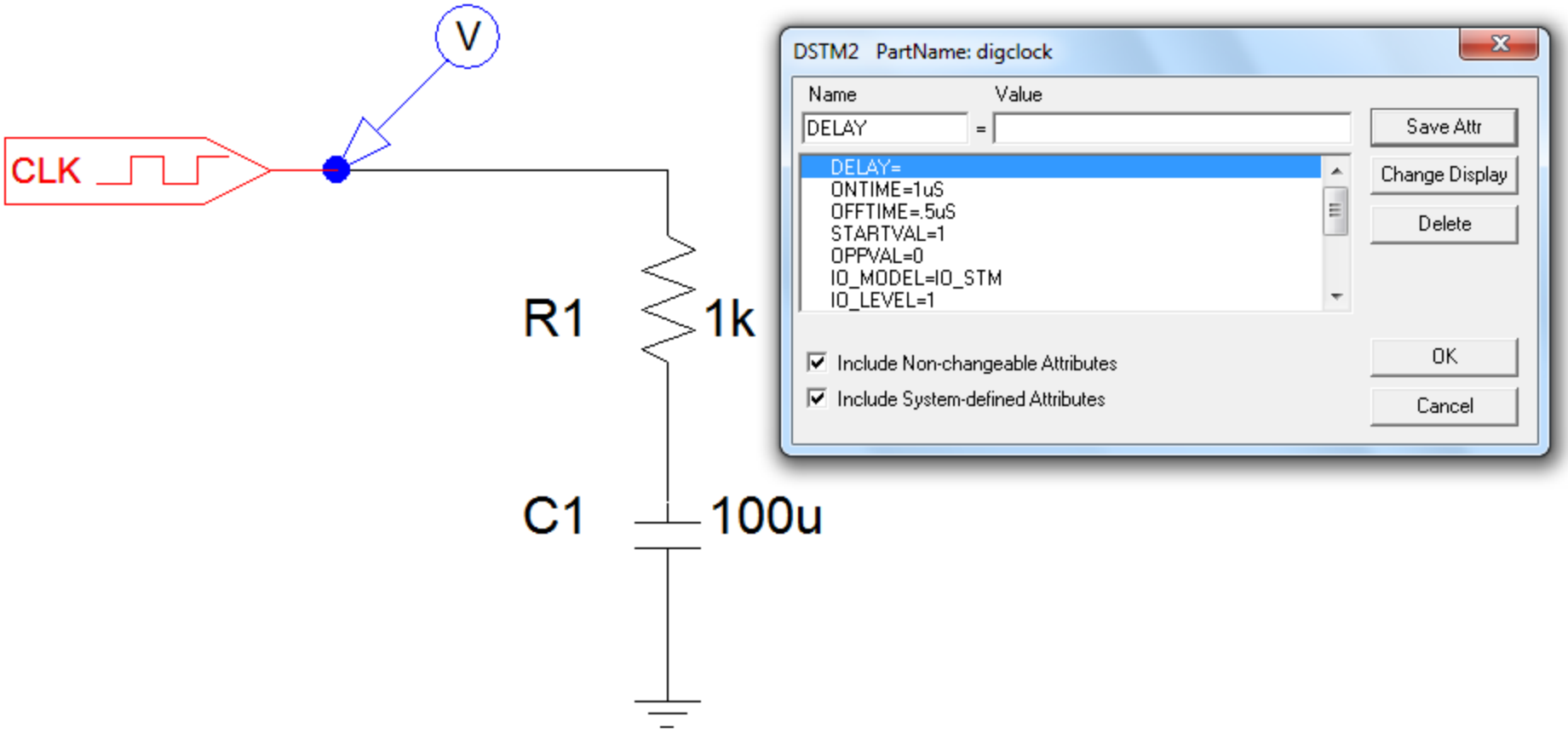


Output of Digclock

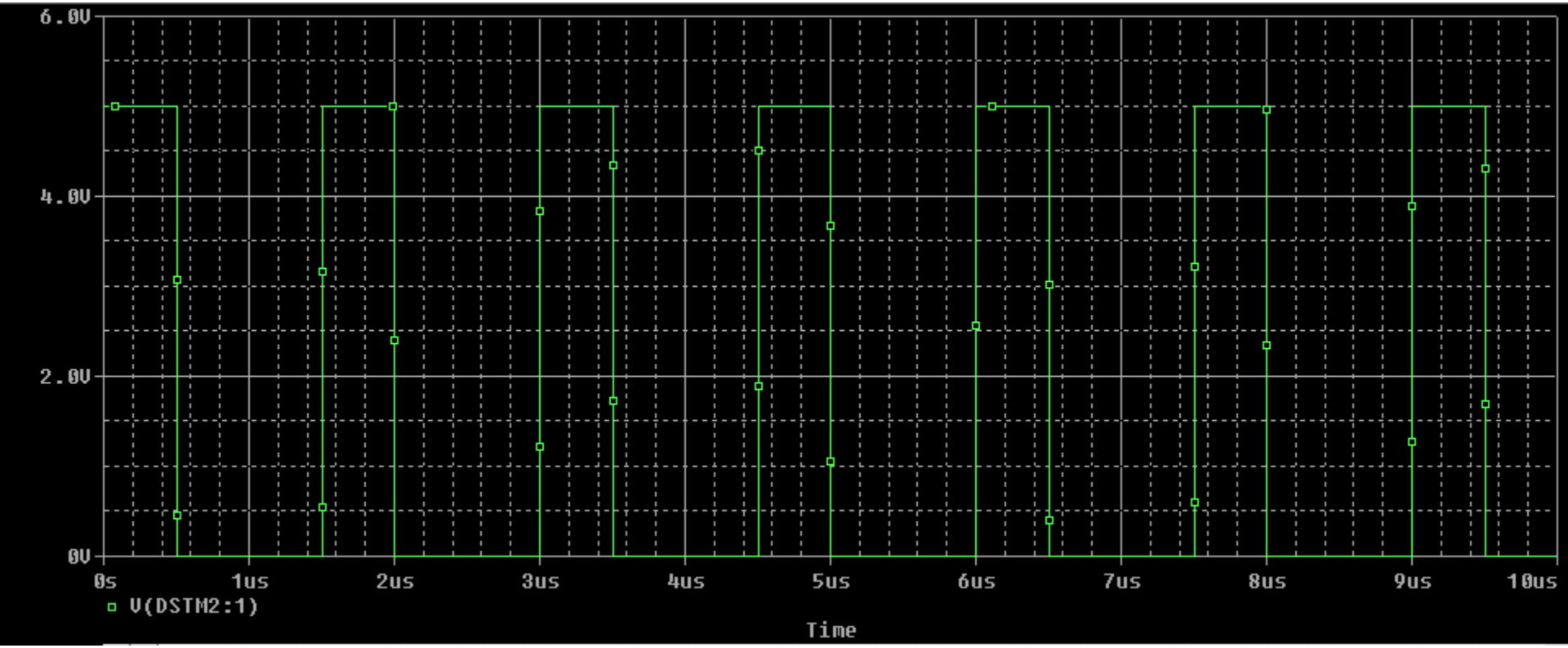


Digclock

The continuous set of pulses start at time = 0s (DELAY =) . The initial voltage is 5V (STARTVAL = 1). Once the pulses start, the pulse length at 0V is 1μs (ONTIME = 1us) and the pulse length at 5V is 0.5 μs (OFFTIME = 0.5us).

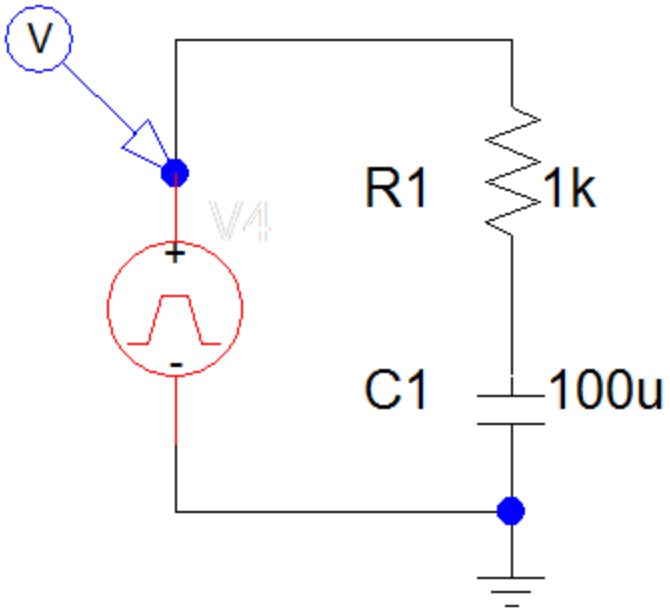


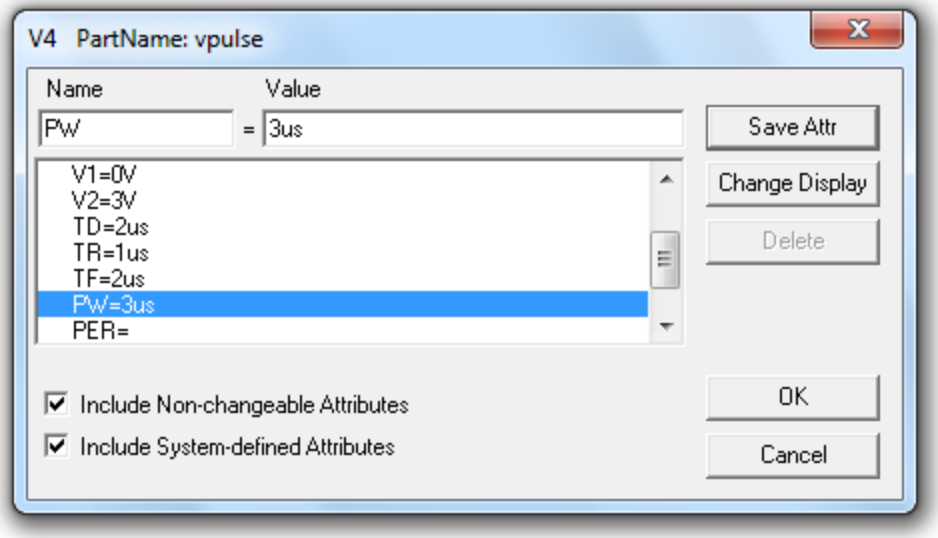
Output of Digclock

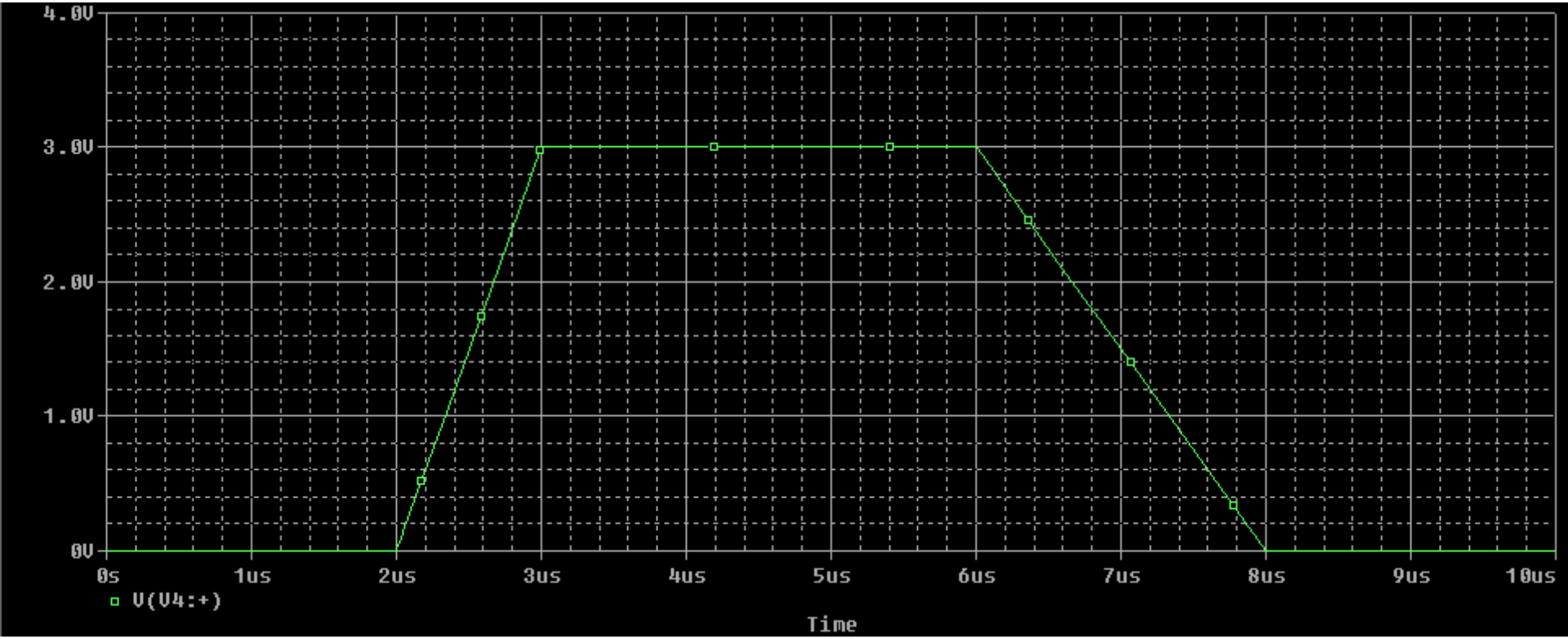


Vpulse

A single pulse (PER =) that does not start until time = 2μs (TD = 2us) . The initial voltage is 0V (V1 = 0). After the delay, the output rises to 3V (V2 = 3V) in 1μs (TR = 1us), stays at 3V for 3μs (PW = 3us), and then takes 2μs to return back to 0V (TF = 2us).

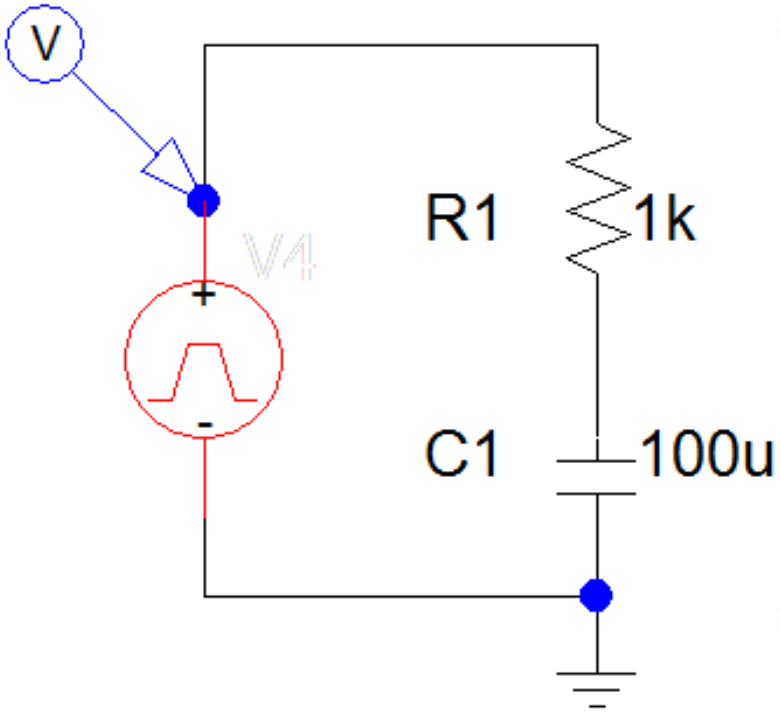


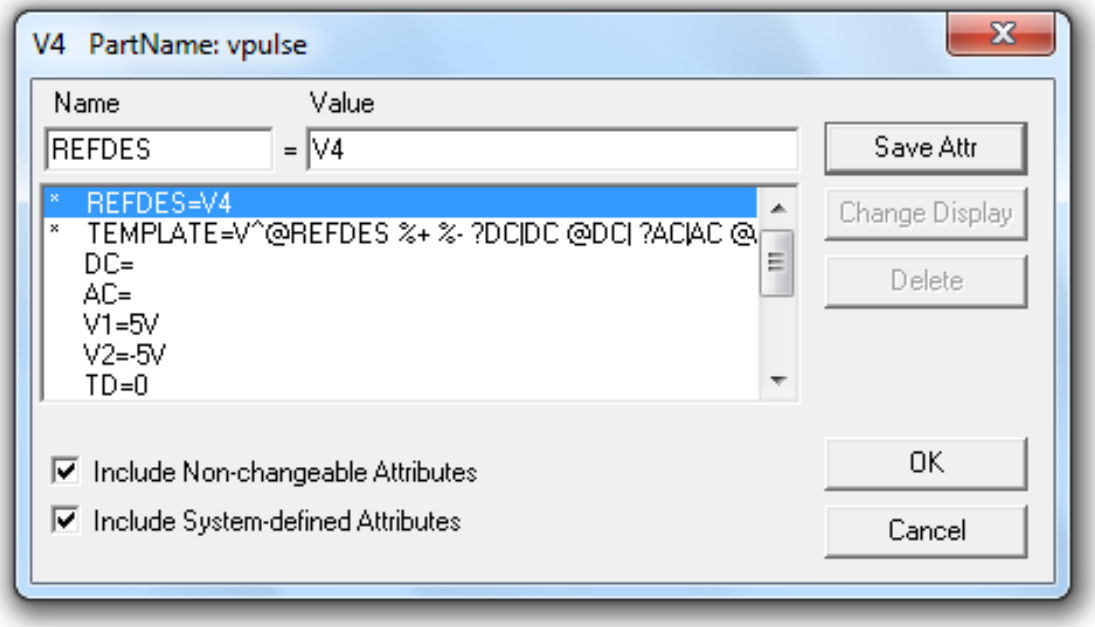



4.0V
3.0V
2.0V
1.0V
0V
0s
1us
2us
3us
4us
5us
6us
7us
8us
9us
10us
V(V4:+)
Time

Vpulse

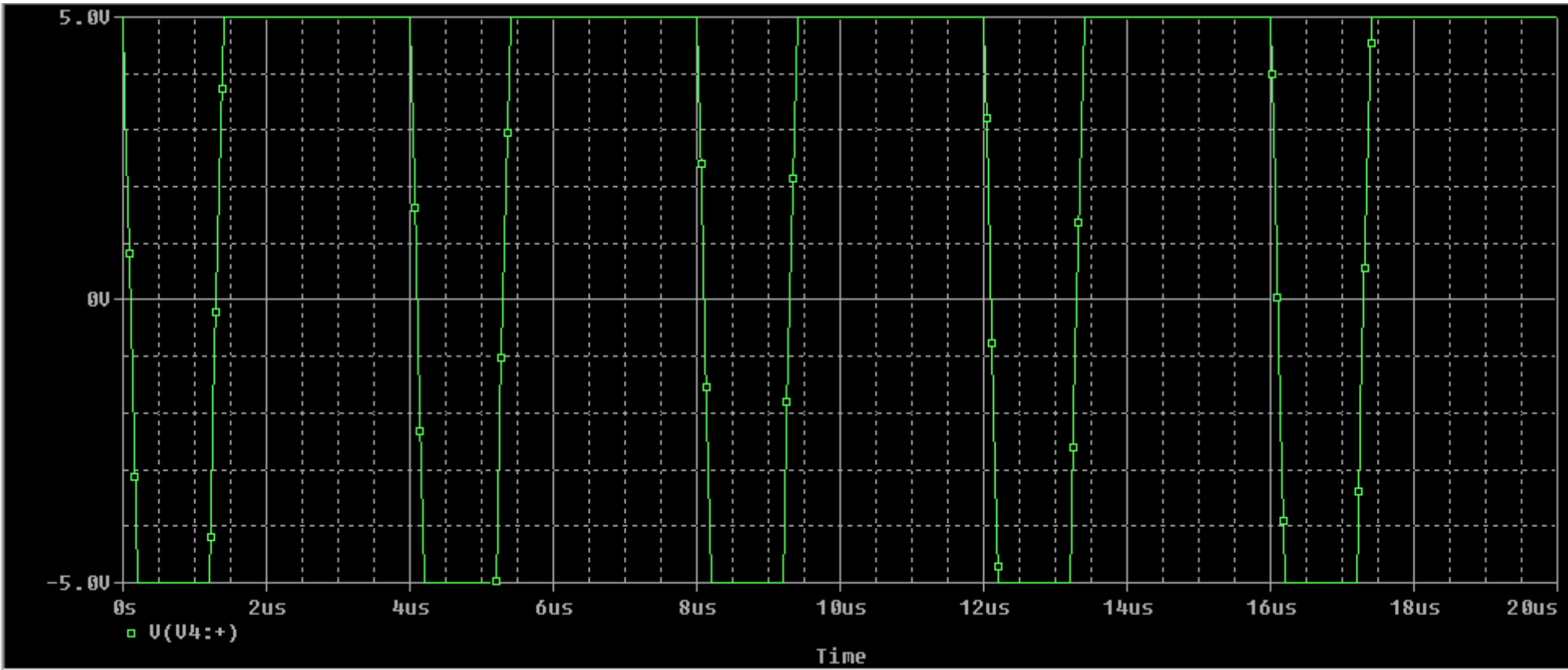
Continuous pulses that repeat every 4µs (PER = 4us) that start immediately (TD = 0) . The initial voltage is +5V (V1 = 5V). The output drops to -5V (V2 = -5V) in 0µs (TR = 0), stays at -5V for 1µs (PW = 1us), and then return back immediately (TF = 0) to +5V.





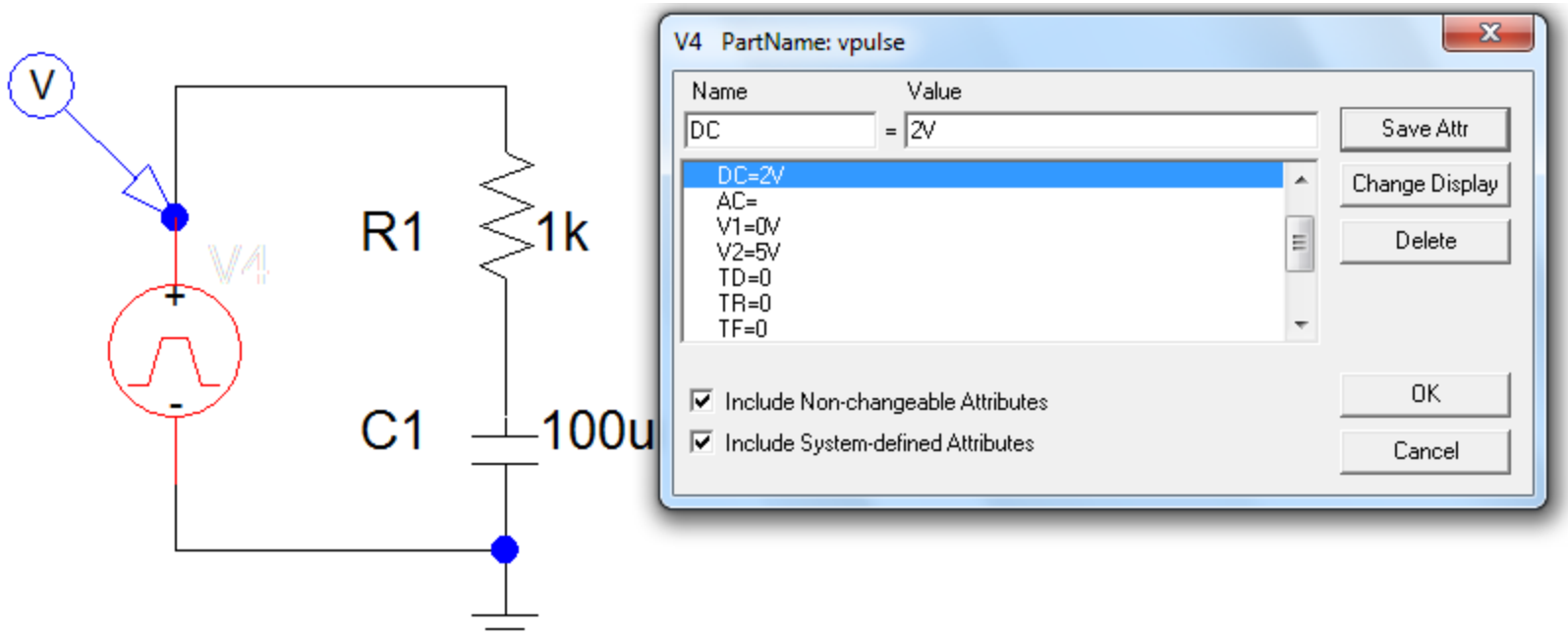
Not quite what was asked for!

There is a default rise and fall time (TR and TF, respectively) that is used by PSpice even when you set these values to 0s. The pulse width is adjusted so that the period of the pulse remains as specified (4μs in this case).



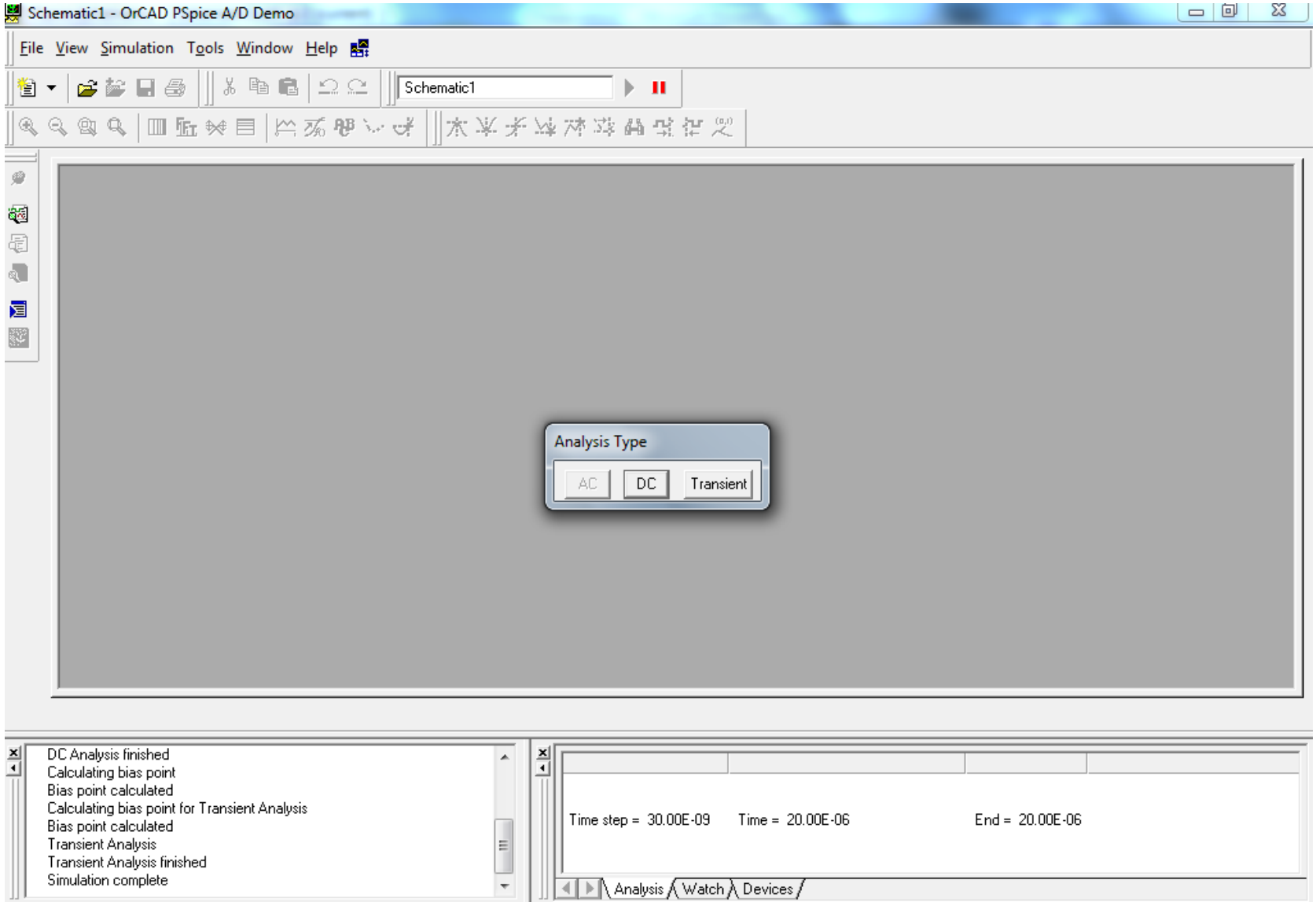
Adding a DC source

Setting DC to 2V allows you to add a DC Sweep to the simulation without having to include a Vdc into the schematic. This DC source is only used in the DC Sweep and does not cause a voltage offset to be added to the pulse when performing a transient analysis.

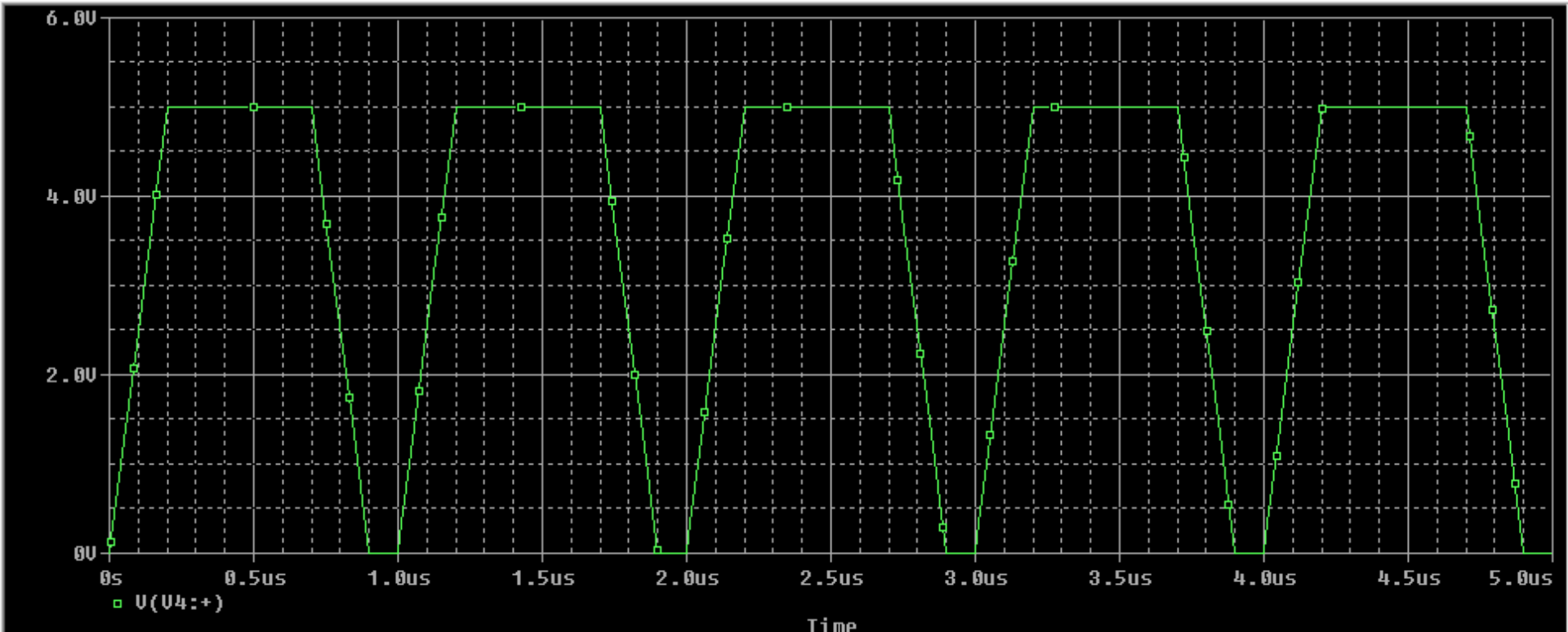


Pulse attributes in this case are continuous pulses that repeat every 1µs (PER = 1us) that start immediately (TD = 0) . The initial voltage is 0V (V1 = 0V). The output rises to 5V (V2 = 5V) in 0µs (TR = 0), stays at -5V for 0.5µs (PW = 0.5us), and then return back immediately (TF = 0) to 0V.

After selecting DC Sweep in addition to Transient in the Simulation Setup and then running the simulation, you can select which output is plotted by clicking on the DC or Transient in the Analysis Type pop-up window.



While the output displayed when Transient is selected is not close to a 50% duty cycle square wave, the 2V DC value entered as an attribute in the Part Name pop-up window does not cause an DC offset voltage.



The value of DC entered as an attribute in the Part Name pop-up window is overridden by the Start Value and End Value that you enter in the DC Sweep pop-up window that is launched when you select DC Sweep in the Analysis Setup pop-up window. However, you must enter some value for DC in the Part Name pop-up window to have the DC Sweep option enabled.

Similarly, you must enter some value for AC in the Part Name pop-up window to have the AC Sweep option enabled during the simulation run.