Name: ……..…. Date: ……..

1. Diode investigation with simulation

Determine the given diodes I-U static characteristics, reverse current value (I_0) and Zener-voltage value (U_Z) with transient analysis!

Diode type*	D1*: MR500	D2*: 1N4148	D3*: 1N752	D4*: 1S1588
U_z				
I_0				
t_{rr} (2. task)				

Circuit:

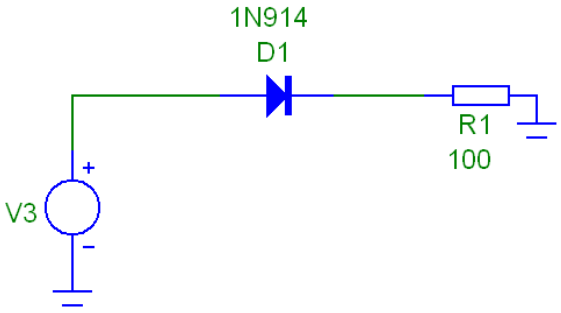
Determine the given diodes reverse rise time (t_{rr}). Write the result into the table of the first task!

Circuit, time diagram:

2. Investigation of diode circuit

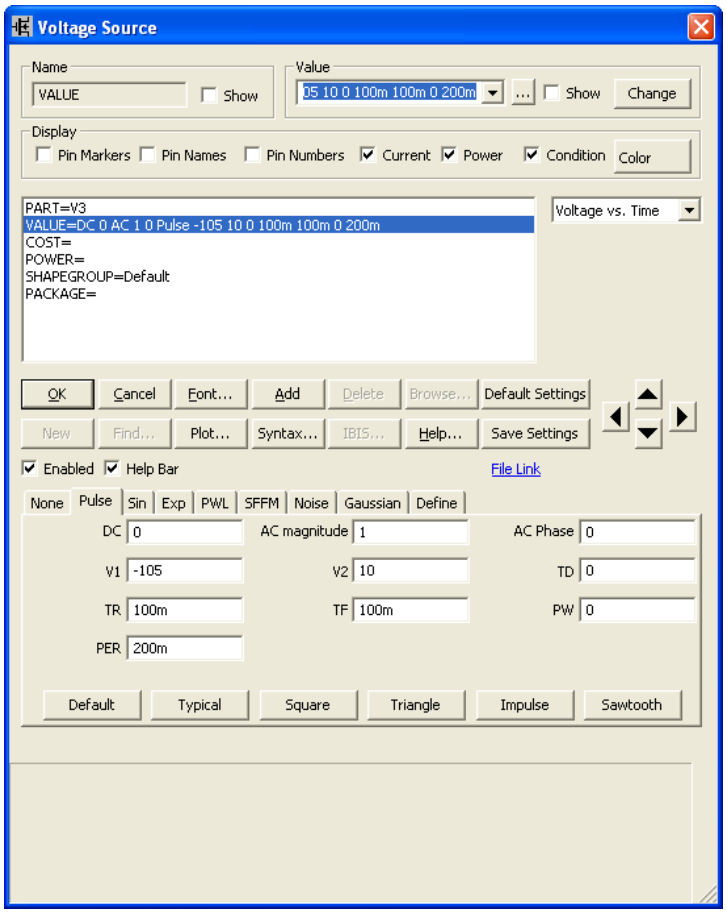
Determine the given diodes I-U **static characteristics**, reverse current value (I_0) and Zener-Voltage value (U_Z) (aka. breakdown voltage) **with transient analysis**!

2.1.1. Measuring circuit



2.1.2. Generator's properties

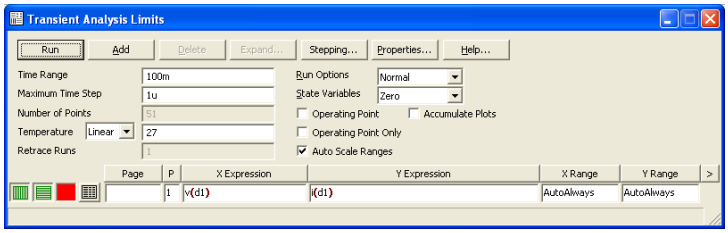
This is a slowly changing triangular signal, where the V1 parameter need to be bigger, than the breakdown voltage of the diode:



2.1.3. Parameters of the transient analysis

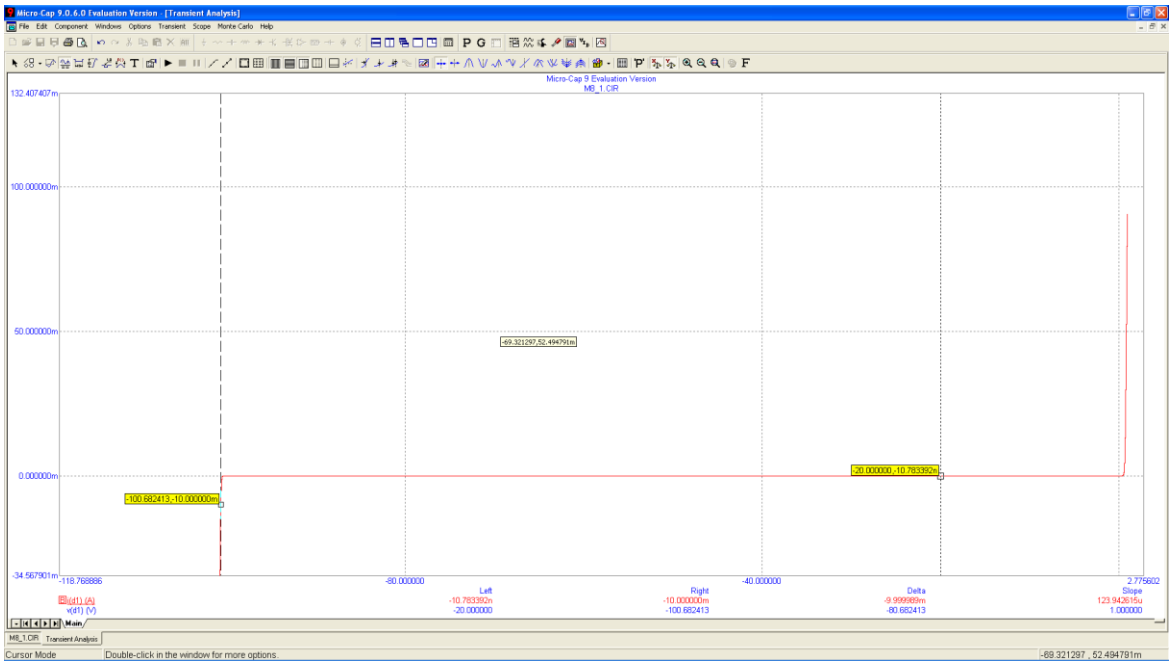
The simulation's time as long as

The simulation time should as long as than the generators signal run from the negative final value to the positive final value (in this case 100 ms), because the diode does not have hysteresis.



2.1.4. Simulation

With clicking to Run button the transient simulation runs and simulation diagram appears. The result of transient analysis is the transfer characteristic which depicts the diode's current as a function of the diode's voltage: the horizontal (X) axis is the voltage and the vertical (Y) is the current.

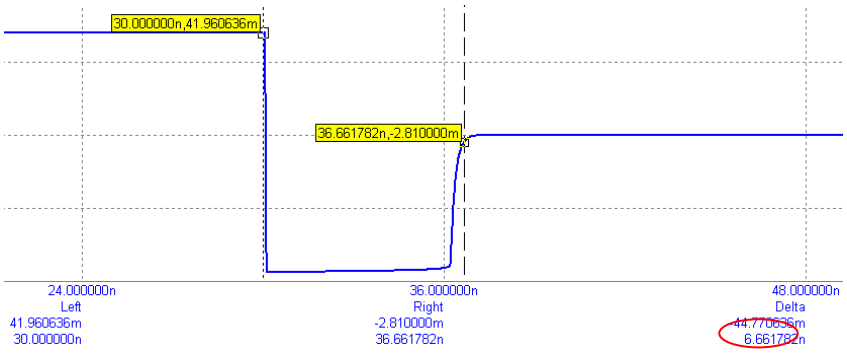


We can get the results in Cursor Mode (or with using the appropriate Go to order – from the menus). **Measure the working point of -10mA and -20V (we can choose other points, too):**

- ☑ Here the breakdown voltage is: -100,682 V (measured beside -10mA: Go to Y)
- ☑ Reverse current is: -10,783nA (measure beside-20V: Go to X)

2.2. Determine the reverse revival time of the

2.2.1. Definition of reverse revival time (t_{rr})

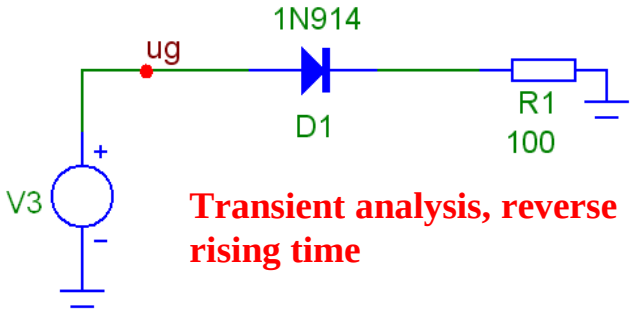


When we dramatically switched the diode from forward direction to reverse direction, then first the diode is conduct (to reverse direction) for a time, yet

When we dramatically switched the diode from forward direction to reverse direction, then first the diode is conduct (to reverse direction) for a time because of the discharching of the charge what is stored in the diode's diffusion capacity (lower extent than the space charge), just after that will closing the diode exactly.

The t_{rr} time is the time from the switching moment when the peak current which is emerged when switching decreased to 5%.

2.2.2. Measuring circuit

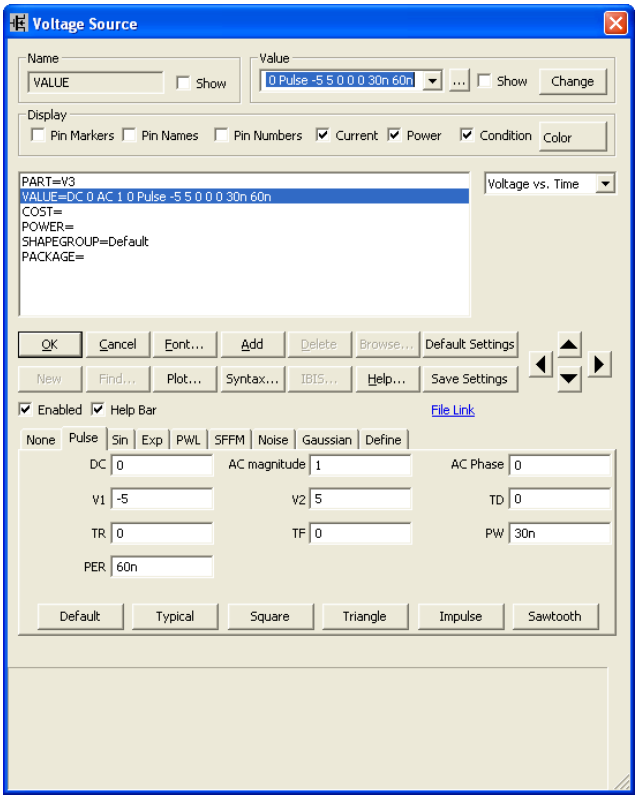


2.2.3. Settings of V3 generator

This is an ideal +,- rectangular signal, the period time

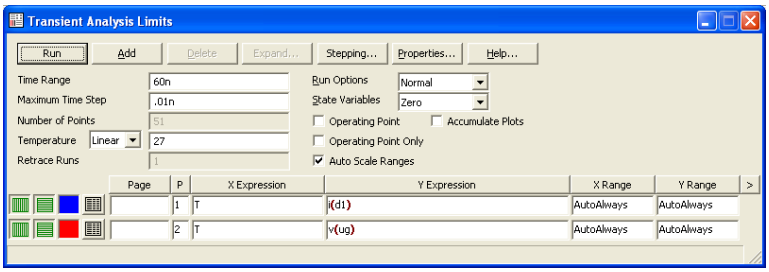
This is an ideal +,- rectangular signal, the period time has to be the expected TT time (trr) 5-10 times higher. The TT parameter is available on the diode's datapage in the simulator. The well-chosen exciter time enlarges the rising time in the simulator, in this way the measurement will be more precisely.

The measuring can be done with bigger currents and higher forward and reverse voltage of the generator!



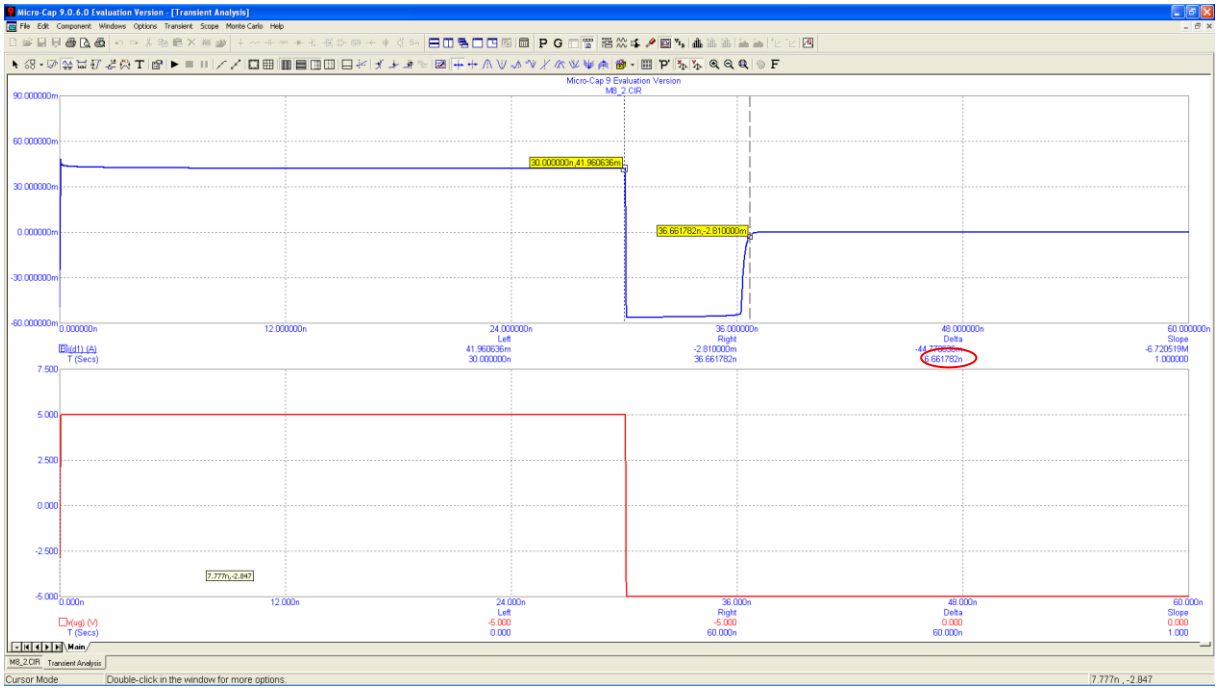
2.2.4. Parameters of transient analysis

We runs the simulation for one period time of the generator. The short simulation time and the short stepping interval (the max. Time Step could be 0.0001ns!) will cause high accuracy.:



2.2.5. Simulation

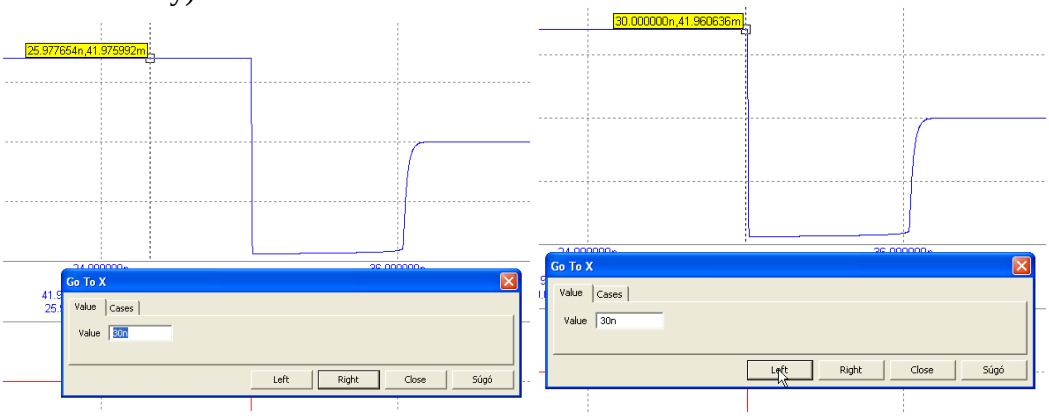
With clicking to Run button the transient simulation runs and simulation diagram appears. On the figure we can see the result of transient analysis where the diode's closing time is shown if we take it from open state to close state. After the diode closing it conducts for a short period of time and then closing totally:



We can read the result of transient simulation from the screen in Cursor Mode (where the current reaches from falling edge to 5% of actual value). We can move the cursors with the appropriate Go to order (or manually).

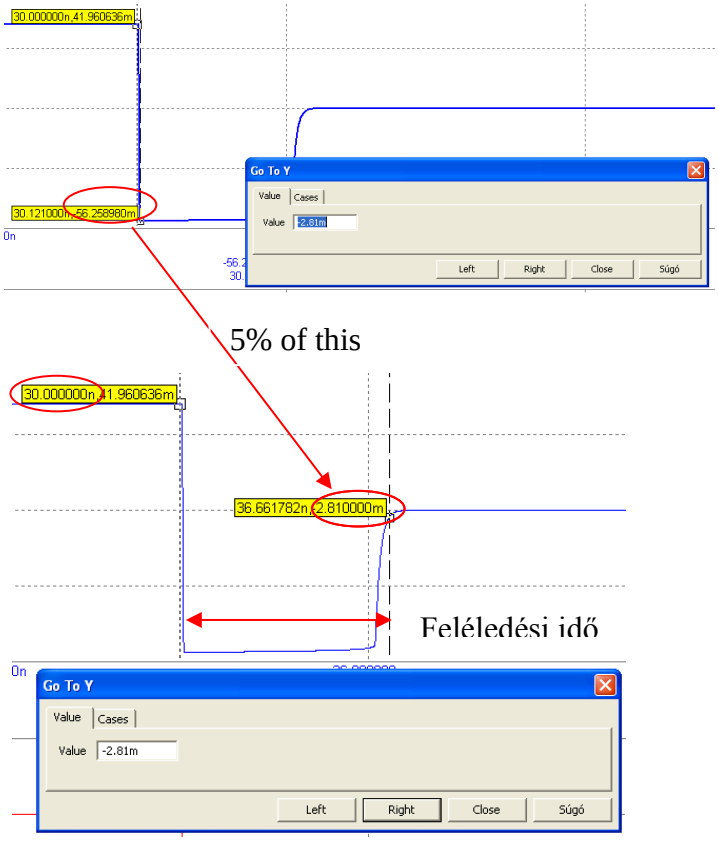
2.2.6. Steps of measuring t_{rr} value

☑ Go to X the left cursor (move to there): to 30n (here is the falling edge of the generator's signal, ie the beginning of closing of the diode, when the diode is not closed exactly)



☑ Put the right cursor (Go to Y) on the minimum to measure the maximal reverse current which flows during the switching. There are a highly valued reverse current (here this is -56.258980 mA, whose 5% is -2.81mA) at the begining of diode turns off.

☑ Go to Y the right cursor: -2.81m (here just 5% of the maximal value of reverse current is flowing, the diode can be considered as closed).:



☑ The reverse rising time (**TT: t_{rr}**) can be read from the bigger figure where the cursors are visible: **6,66ns**