## ROHM Solution Simulator

**Nano Cap™, Low Noise & Input/Output Rail-to-Rail High Speed CMOS Operational Amplifier for Automotive**

# BD7280YG-C – Voltage Follower (Pulse Input) – Transient Response simulation

This circuit simulates the transient response to pulse input with voltage follower configured Op-Amps. You can observe the fluctuation of the output voltage when the input voltage is abruptly changed. You can customize the parameters of the components shown in blue, such as VSOURCE, or peripheral components, and simulate the voltage follower with the desired operating condition.

You can simulate the circuit in the published application note: Operational amplifier, Comparator (Tutorial). [JP] [EN] [CN] [KR]

### General Cautions

*Caution 1:* The values from the simulation results are not guaranteed. Please use these results as a guide for your design.
*Caution 2:* These model characteristics are specifically at Ta=25°C. Thus, the simulation result with temperature variances may significantly differ from the result with the one done at actual application board (actual measurement).
*Caution 3:* Please refer to the Application note of Op-Amps for details of the technical information.
*Caution 4:* The characteristics may change depending on the actual board design and ROHM strongly recommend to double check those characteristics with actual board where the chips will be mounted on.

## 1 Simulation Schematic

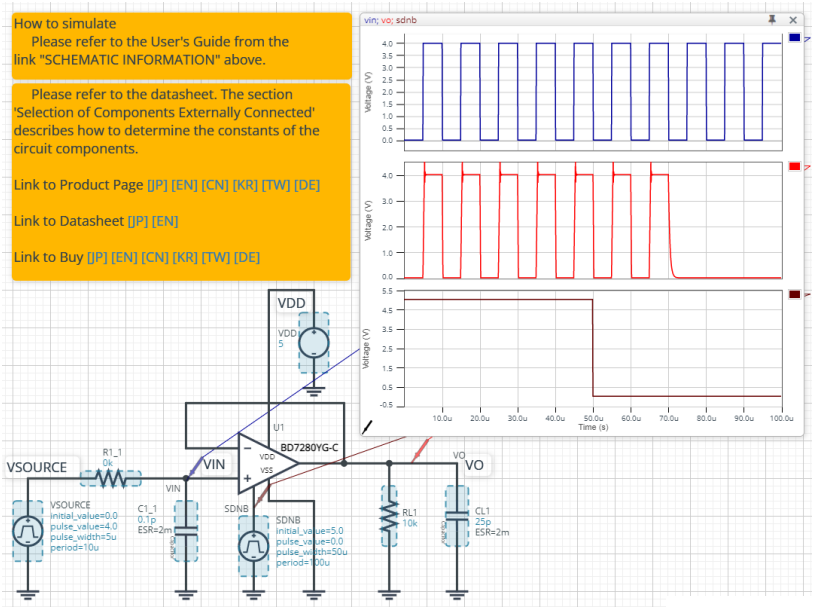



Figure 1. Simulation Schematic

## 2 How to simulate

The simulation settings, such as parameter sweep or convergence options, are configurable from the 'Simulation Settings' shown in Figure 2, and Table 1 shows the default setup of the simulation.

In case of simulation convergence issue, you can change advanced options to solve. The temperature is set to 27 °C in the default statement in 'Manual Options'. You can modify it.

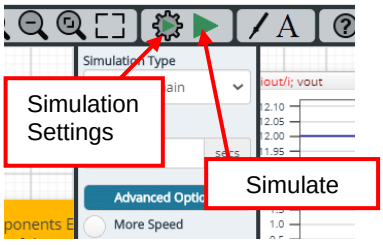



Figure 2. Simulation Settings and execution

Table 1. Simulation settings default setup

| Parameters | Default | Note |
|---|---|---|
| Simulation Type | Time-Domain | Do not change Simulation Type |
| End Time | 100 µs | - |
| Advanced options | Balanced | - |
| | Time Resolution Enhancement<br>Convergence Assist | - |
| Manual Options | .temp 27 | - |

## 3 Simulation Conditions

Table 2. List of the simulation condition parameters

| Instance Name | Type | Parameters | Default Value | Variable Range | | Units |
|---|---|---|---|---|---|---|
| | | | | Min | Max | |
| VSOURCE | Voltage Source | Initial_value | 0 | 0 | 5.5 | V |
| | | Pulse_value | 4 | 0 | 5.5 | V |
| | | ramptime_initial_to_pulse | 100 | free | | ns |
| | | ramptime_pulse_to_initial | 100 | free | | ns |
| | | Start_delay | 5 | free | | µs |
| | | Pulse_width | 5 | free | | µs |
| | | Period | 10µ | 100n | 100m | s |
| VDD | Voltage Source For Op-Amp | Voltage_level | 5 | 2.5*(Note1)* | 5.5*(Note1)* | V |
| | | AC_magnitude | 0.0 | fixed | | V |
| | | AC_phase | 0.0 | fixed | | ° |
| SDNB | Voltage Source For Shutdown Setting | Initial_value | 5 | VSS | VDD | V |
| | | Pulse_value | 0 | VSS | VDD | V |
| | | ramptime_initial_to_pulse | 100 | free | | ns |
| | | ramptime_pulse_to_initial | 100 | free | | ns |
| | | Start_delay | 50 | free | | µs |
| | | Pulse_width | 50 | free | | µs |
| | | Period | 100µ | 100µ | - | s |

*(Note 1)* Set it to the guaranteed operating range of the Op-Amps.

### 3.1 VSOURCE parameter setup

Figure 3 shows how the VSOURCE parameters correspond to the VIN stimulus waveform.

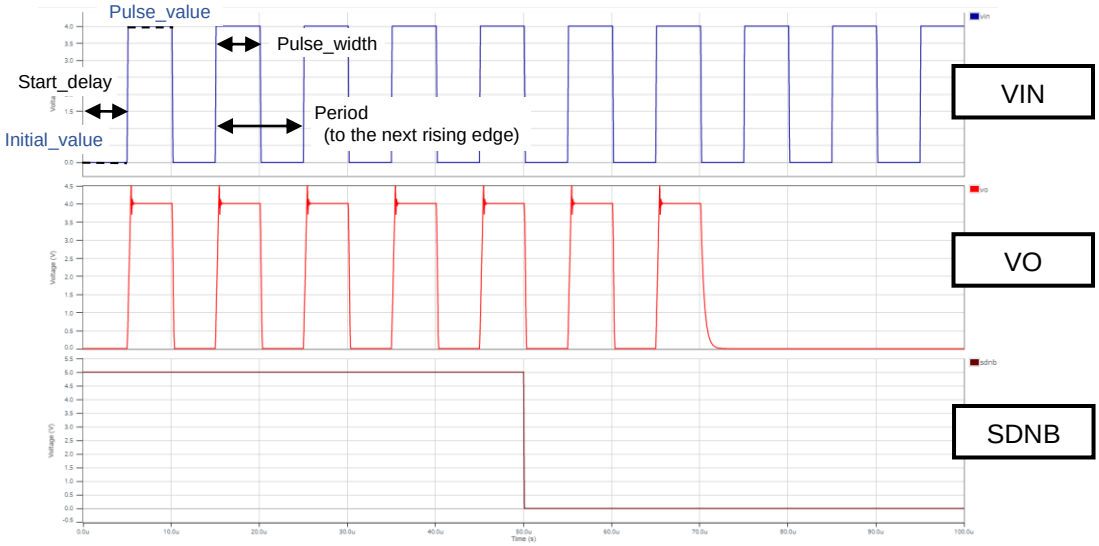



Figure 3. VSOURCE parameters and its waveform

## 4 Op-Amp model

Table 3 shows the model pin function implemented. Note that the Op-Amp model is the behavioral model for its input/output characteristics, and neither protection circuits nor functions unrelated to the purpose are implemented.

Table 3. Op-Amp model pins used for the simulation

| Pin Name | Description |
|---|---|
| +IN | Non-inverting input |
| -IN | Inverting input |
| VDD | Positive power supply |
| VSS | Negative power supply / Ground |
| OUT | Output |
| SDNB | Shutdown setting |

# 5 Peripheral Components

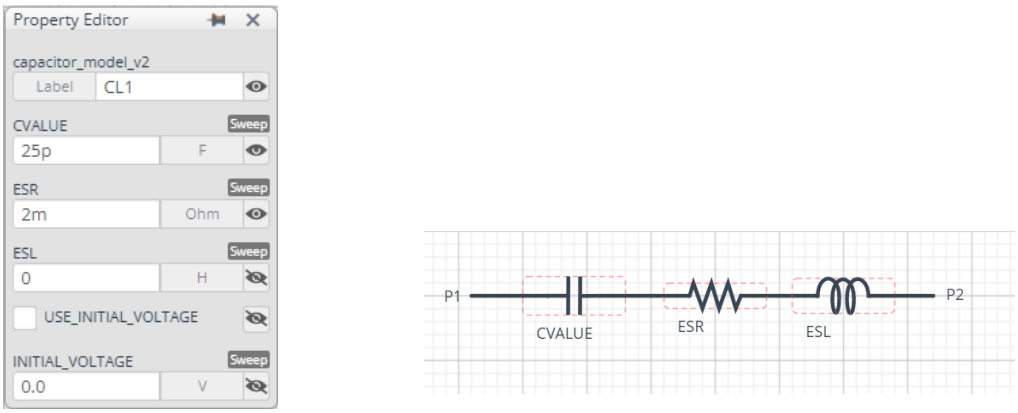
## 5.1 Bill of Material

Table 4 shows the list of components used in the simulation schematic. Each of the capacitors has the parameters of equivalent circuit shown below. The default values of equivalent components are set to zero except for the ESR of C. You can modify the values of each component.

Table 4. List of capacitors used in the simulation circuit

| Type | Instance Name | Default Value | Variable Range | | Units |
|---|---|---|---|---|---|
| | | | Min | Max | |
| Resistor | R1_1 | 0 | 0 | 10 | kΩ |
| | RL1 | 10k | 1k | 1M, NC | Ω |
| Capacitor | C1_1 | 0.1 | 0.1 | 22 | pF |
| | CL1 | 25 | free, NC | | pF |

## 5.2 Capacitor Equivalent Circuits




(a) Property editor (b) Equivalent circuit

Figure 4. Capacitor property editor and equivalent circuit

The default value of ESR is 2m Ω.

*(Note 2)* These parameters can take any positive value or zero in simulation but it does not guarantee the operation of the IC in any condition. Refer to the datasheet to determine adequate value of parameters.

# 6 Recommended Products

6.1 Op-Amp

BD7280YG-C : Nano Cap™, Low Noise & Input/Output Rail-to-Rail High Speed CMOS Operational Amplifier for Automotive. [JP] [EN] [CN] [KR] [TW] [DE]

Technical Articles and Tools can be found in the Design Resources on the product web page.