## ROHM Solution Simulator

### Current Sense Amplifier

# BD14210G-LA High-Side Current Sensing Circuit – Transient Response simulation

This circuit simulates the transient response at the high-side current sensing with BD14210G-LA. You can observe the fluctuation of the output voltage when the source or load current, or effectively the input voltage or shunt voltage, is abruptly changed. You can customize the parameters of the components shown in blue, such as VIN, or peripheral components, and simulate the high-side current sensing circuit with the desired operating condition.

### 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 Current Sense Amplifiers 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

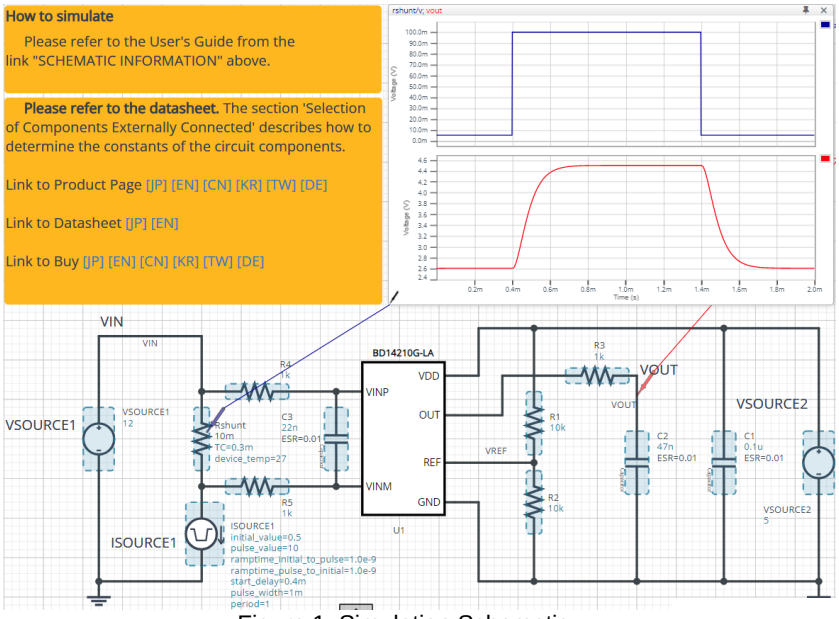


Figure 1. Simulation Schematic

## 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. Nothing is stated in the default statement in 'Manual Options'. You can modify it.

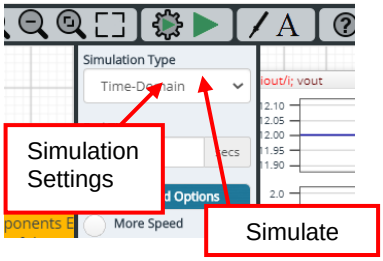


Figure 2. Simulation Settings and execution

Table 1. Simulation settings default setup

| Parameters | Default | Note |
|---|---|---|
| Simulation Type | Time-Domain | Do not change Simulation Type |
| End Time | 2ms | - |
| Advanced options | Simulation Resolution | 1e-7 |
| | Convergence Assist | - |
| Manual Options | - | - |

## 3 Simulation Conditions

Table 2. List of the simulation condition parameters

| Instance Name | Type | Parameters | Default Value | Variable Range | | Units |
|---|---|---|---|---|---|---|
| | | | | Min | Max | |
| VSOURCE1 | Voltage Source | Voltage_level | 12 | -0.2 | 26 | V |
| | | AC_magnitude | 0.0 | fixed | | V |
| | | AC_phase | 0.0 | fixed | | ° |
| VSOURCE2 | Voltage Source For Current Sense Amplifier | Voltage_level | 5 | 2.7 *(Note1)* | 5.5*(Note1)* | V |
| | | AC_magnitude | 0.0 | fixed | | V |
| | | AC_phase | 0.0 | fixed | | ° |
| ISOURCE | Current Source | Initial_value | 0.5 | free | | A |
| | | Pulse_value | 10 | free | | A |
| | | ramptime_initial_to_pulse | 1.0 | free | | ns |
| | | ramptime_pulse_to_initial | 1.0 | free | | ns |
| | | Start_delay | 0.4 | free | | ms |
| | | Pulse_width | 1 | free | | ms |
| | | Period | 1 | free | | s |

*(Note 1)* Set it to the guaranteed operating range of the Amplifiers.

### 3.1 ISOURCE parameter setup

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

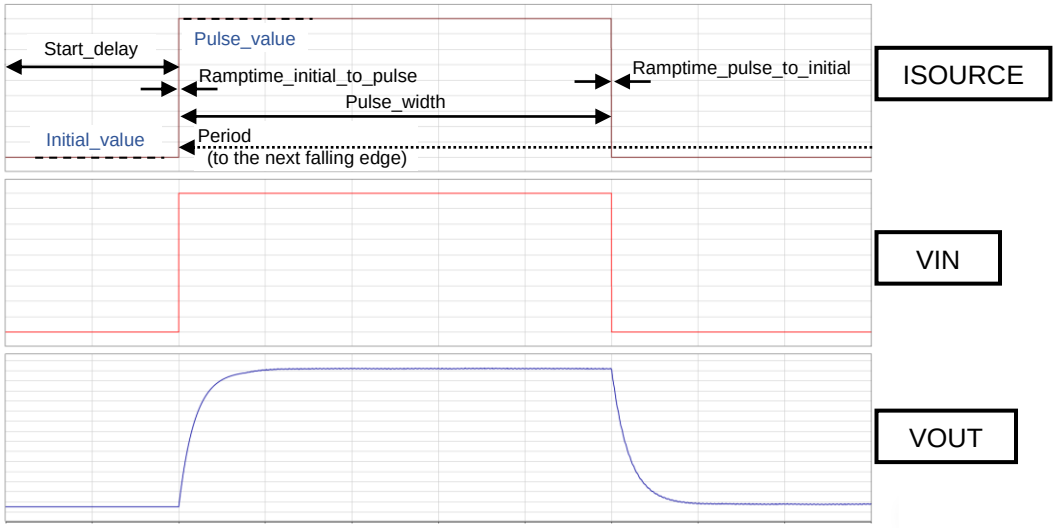


Figure 3. ISOURCE parameters and its waveform

## 4 Amplifier model

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

Table 3. Amplifier model pins used for the simulation

| Pin Name | Description |
|---|---|
| VINP | Input of supply side of shunt resistor. |
| VINM | Input of load side of shunt resistor. |
| VDD | Power supply. |
| OUT | Current detection output. |
| REF | Reference input. |
| GND | Ground. |

# 5 Peripheral Components

## 5.1 Bill of Material

Table 4 shows the list of components used in the simulation schematic. The default values of equivalent components are set to zero except for the ESR of C1. The model parameters of Rshunt are shown below. 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 | Rshunt | 10 | free | | mΩ |
| | R1 | 10 | free | | kΩ |
| | R2 | 10 | free | | kΩ |
| | R3 | 1 | free | | kΩ |
| | R4 | 1 | free | | kΩ |
| | R5 | 1 | free | | kΩ |
| Capacitor | C1 | 0.1 | free | | µF |
| | C2 | 47 | free | | nF |
| | C3 | 22 | free | | nF |

## 5.2 Rshunt Model Parameters

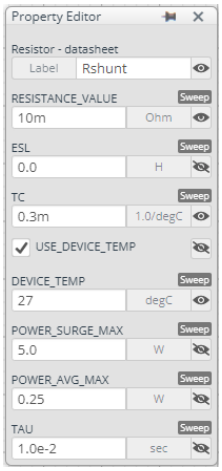


Figure 4. Rshunt property editor

Figure 4 shows the model parameters of Rshunt. The default values of Rshunt and TC are 10m Ω and 0.3m Ω/°C respectively.

*(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 Current Sense Amplifier

BD14210G-LA : Current Sense Amplifier. [JP] [EN] [CN] [KR] [TW] [DE]

6.2 Shunt Resistor

LTR50UZPFU : High Power Low Ohmic Chip Resistor. [JP] [EN] [CN] [KR] [TW] [DE]

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

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