

ROHM Solution Simulator

4.5 V to 28 V Input, 2.0 A Integrated MOSFET Single Synchronous Buck DC/DC Converter **BD9E201FP4-Z / Load Response**

This circuit simulates the load response of BD9E201FP4-Z. You can observe the fluctuation of the output voltage when the load current is abruptly changed. You can customize the parameters of the components shown in blue, such as VIN, IOUT, or peripheral components, and simulate the load response with desired operating condition.

General Cautions

Caution 1: The values from the simulation results are not guaranteed. 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 datasheet 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

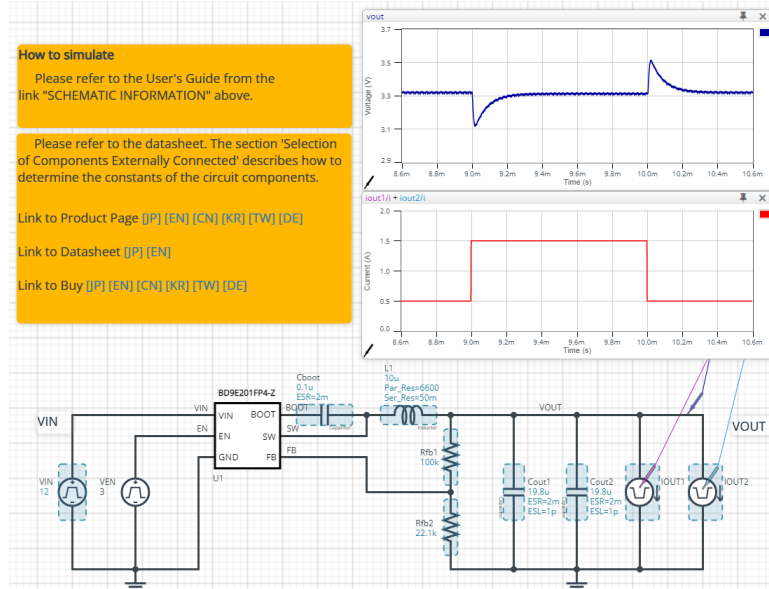


Figure 1. Simulation Schematic

2 How to simulate

The simulation settings, such as time domain 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 25 °C in the default statement in 'Manual Options'.

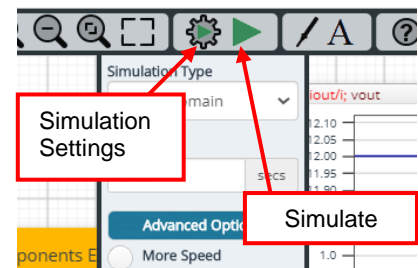


Figure 2. Simulation Settings and execution

Table 1. Simulation settings default setup

Parameters	Default	Note
Simulation Type	Time-Domain	Do not change Simulation Type
End Time	12 ms	
Advanced options	Balanced	
	Time Resolution Enhancement	
	Convergence Assist	
Manual Options	".temp 25"	

3 Simulation Conditions

Table 2. List of the simulation condition parameters

Instance Name	Type	Parameters	Default Value	Variable Range		Units
				Min	Max	
VIN	Voltage Source	Initial_value	0	-		V
		Pulse_value	12	4.5	28	V
		ramptime_initial_to_pulse	1	No constraint ^(Note1)		μs
		ramptime_pulse_to_initial	1	No constraint ^(Note1)		μs
		Start_delay	0.1	-		ms
		Pulse_width	10	-		s
		Period	11	-		s
VEN	Voltage Source	Initial_value	0	-		V
		Pulse_value	3	-		V
		ramptime_initial_to_pulse	1	No constraint ^(Note1)		μs
		ramptime_pulse_to_initial	1	No constraint ^(Note1)		μs
		Start_delay	0.11	-		ms
		Pulse_width	10	-		s
		Period	11	-		s
IOUT1	Current Source	Initial_value	0	-		A
		Pulse_value	0.5	0	2 ^(Note2)	A
		ramptime_initial_to_pulse	1	No constraint ^(Note1)		μs
		ramptime_pulse_to_initial	1	No constraint ^(Note1)		μs
		Start_delay	6	-		ms
		Pulse_width	10	-		s
		Period	11	-		s
IOUT2	Current Source	Initial_value	0	-		A
		Pulse_value	1	0	2 ^(Note2)	A
		ramptime_initial_to_pulse	1	No constraint ^(Note1)		μs
		ramptime_pulse_to_initial	1	No constraint ^(Note1)		μs
		Start_delay	9	-		ms
		Pulse_width	1	-		ms
		Period	10	-		s

(Note 1) This is a constraint of the simulation settings and does not guarantee the operation of the IC.

(Note 2) The maximum sum value of IOUT1 and IOUT2 is 2 A.

4 BD9E201FP4-Z model

The simulation model in this circuit is designed for load response, and the functions not related to load response are not implemented.

Table 3. BD9E201FP4-Z model pins used for load response

Pin Name	Description
VIN	Power supply input.
EN	Enable input.
BOOT	Pin for bootstrap.
SW	Switching node.
FB	Output voltage feedback pin.
GND	Ground.

5 Peripheral Components

To set parameters of components, open 'property' by double click or right click on a component. You can input a value to a property text box if available. Please refer to the hands-on manual for more details.

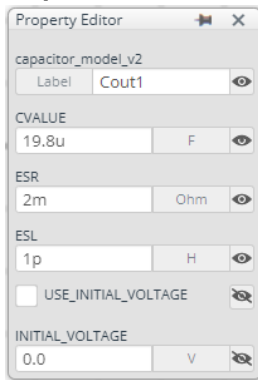
5.1 Bill of Material

Table 4 shows the list of components used in the simulation schematic. Each of the capacitor and inductor has the parameters of equivalent circuit shown below. The default value of equivalent components are set to zero except for the parallel and series resistance of L1, series resistance of capacitors, and series inductance of output capacitors. You can modify the values of each component.

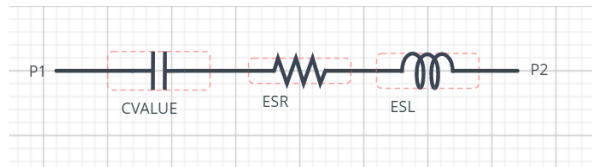
Table 4. List of components used in the simulation circuit

Type	Instance Name	Default Value	Units
Capacitor	Cboot	0.1	μF
	Cout1	19.8	μF
	Cout2	19.8	μF
Inductor	L1	10	μH
Resistor	Rfb1	100	$\text{k}\Omega$
	Rfb2	22.1	$\text{k}\Omega$

5.2 Capacitor Equivalent Circuits



(a) Property editor

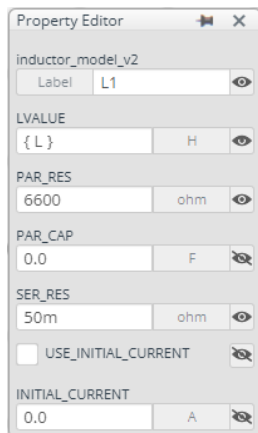


(b) Equivalent circuit

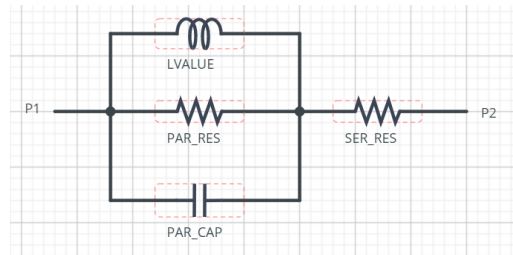
Figure 1. Capacitor property editor and equivalent circuit

The default value of ESR is 2 m Ω and ESL is 1 pH.

5.3 Inductor Equivalent Circuits



(a) Property editor



(b) Equivalent circuit

Figure 2. Inductor property editor and equivalent circuit

The default value of PAR_RES is 6.6 k Ω and SER_RES is 50 m Ω .

(Note 3) 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 Link to the product information and tools

- 6.1 DC/DC Converter
BD9E201FP4-Z : Integrated MOSFET Single Synchronous Buck DC/DC Converter. [\[JP\]](#) [\[EN\]](#) [\[CN\]](#) [\[KR\]](#) [\[TW\]](#) [\[DE\]](#)
- 6.2 General Purpose Chip Resistors
MCR01MZPF : Thick Film Chip Resistors. [\[JP\]](#) [\[EN\]](#) [\[CN\]](#) [\[KR\]](#) [\[TW\]](#) [\[DE\]](#)

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

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