(A-011-D) DC-AC Totem-Pole PFC Diode Rectification (Discrete)

ROHM PLECS Simulator
Simulation Example

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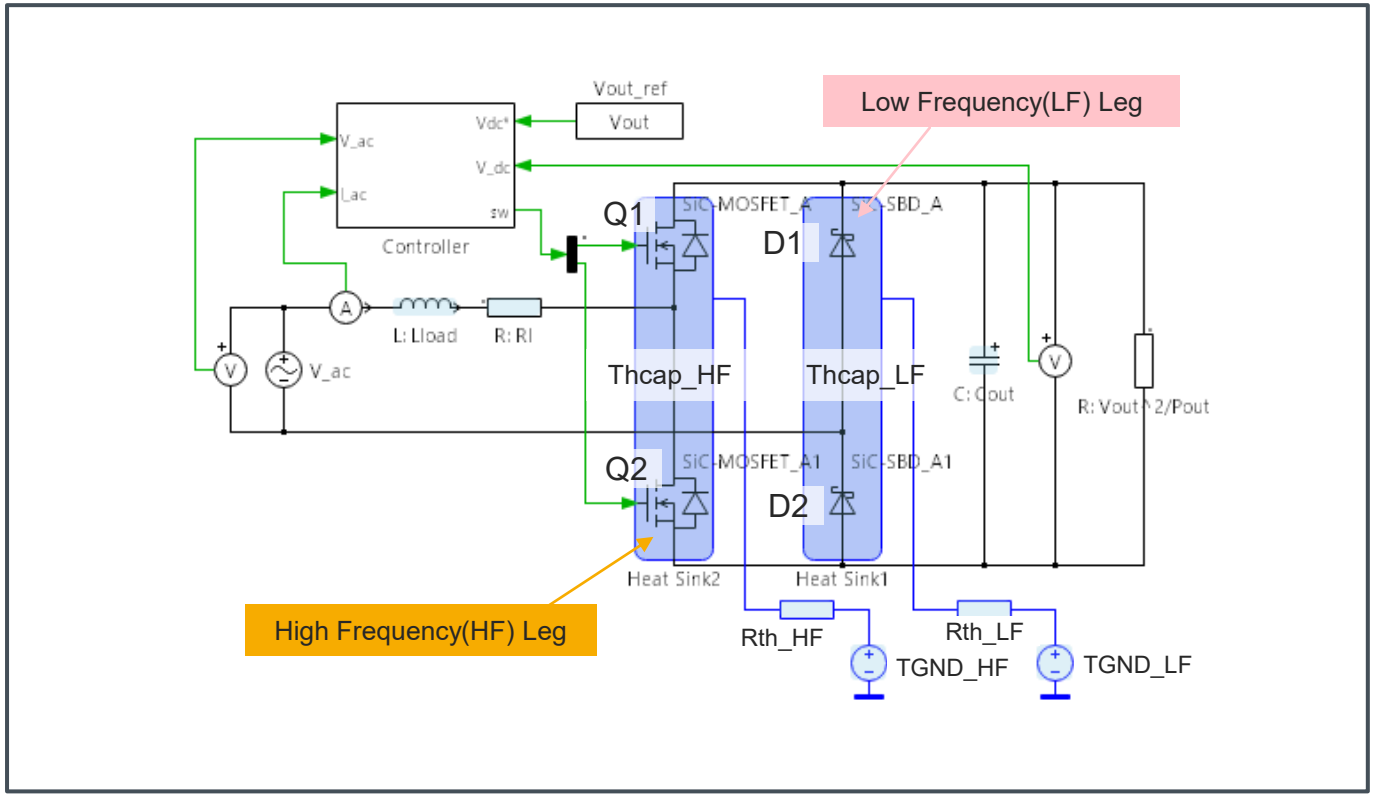
Simulation Parameters (Dialog)

	Name	Content	unit	Default Value	Variable Range
	L	Inductive Load	H	470u	1n ～ 1
	Rl	Parasitic Resistance	Ω	1m	1u ～ 100m
	C	Output Capacitor Initial Voltage	F V	470u 500	1n ～ 1 0 ～ 1200
High-Freq. Leg	Thcap_HF	Thermal Capacitance	J/K	0.1	1m ～ 100
High-Freq. Leg	Rth_HF	Thermal Resistance	K/W	0.5	1m ～ 100
High-Freq. Leg	TGND_HF	Thermal GND Temperature	℃	25	-40 ～ 175
Low-Freq. Leg	Thcap_LF	Thermal Capacitance	J/K	0.1	1m ～ 100
Low-Freq. Leg	Rth_LF	Thermal Resistance	K/W	0.5	1m ～ 100
Low-Freq. Leg	TGND_LF	Thermal GND Temperature	℃	25	-40 ～ 175

Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.5	100u ～ 0.5
fs	Switching Frequency	Hz	60k	10k ～ 100k
V_ac(rms)	Input Voltage Grid Frequency	V Hz	220 50	100 ～ 500 50 or 60
Vout (dc)	Output Voltage	V	500	300 ～ 1200
Pout	Output Power	W	2500	100 ～ 30000
Rg_on	Gate Resistance (Source)	Ω	6.8	0.1 ～ 100
Rg_off	Gate Resistance (Sink)	Ω	6.8	0.1 ～ 100
T_init	Initial Junction Temperature	℃	25	-40 ～ 175

Simulation Circuit



Power Devices

Name	Device Type	Part No.	Specification
Q1,2	SiC MOSFET	SCT4065DR	750V/ 25A/ 65mΩ/ TO-247-4L
D1,2	SiC Schottky Barrier Diode	SCS320AG	650V/ 20A/ TO-220ACGE

Simulation Screen Overview

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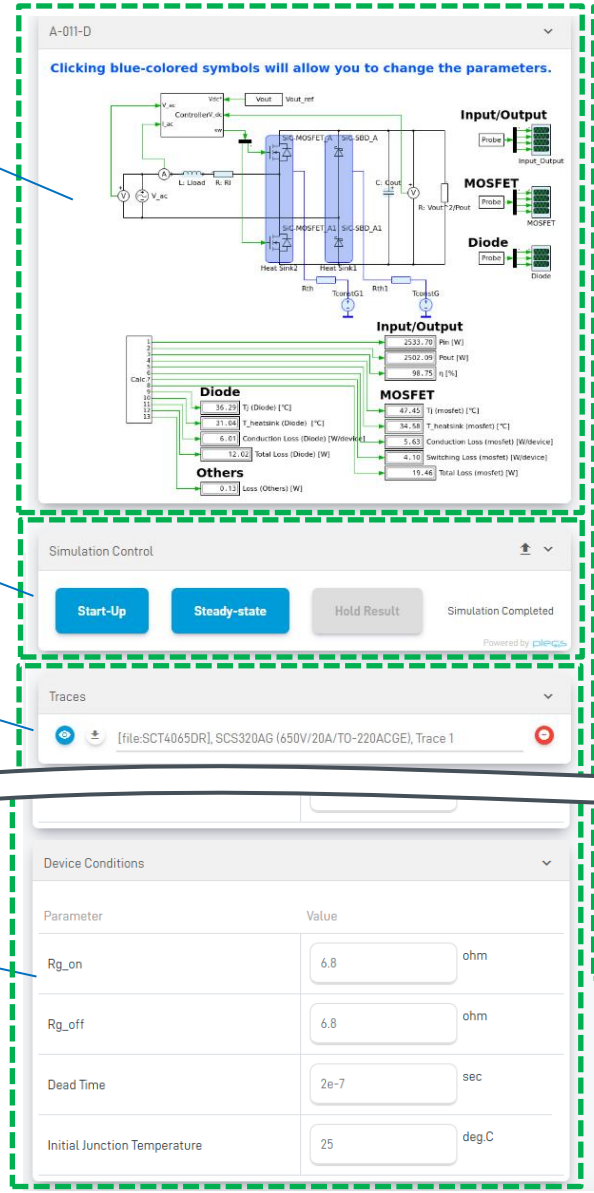
Schematic window
- Dialog parameters setting
- Results display

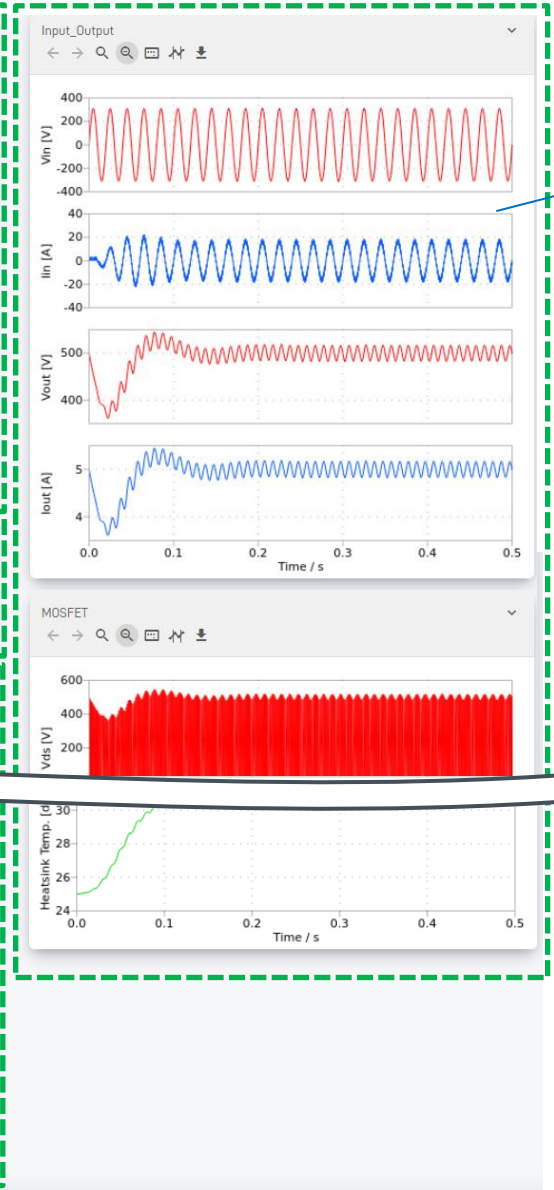
Simulation control

Trace selection

Table parameters setting



Waveforms



Simulation Results

Simulation Mode: Start-UP

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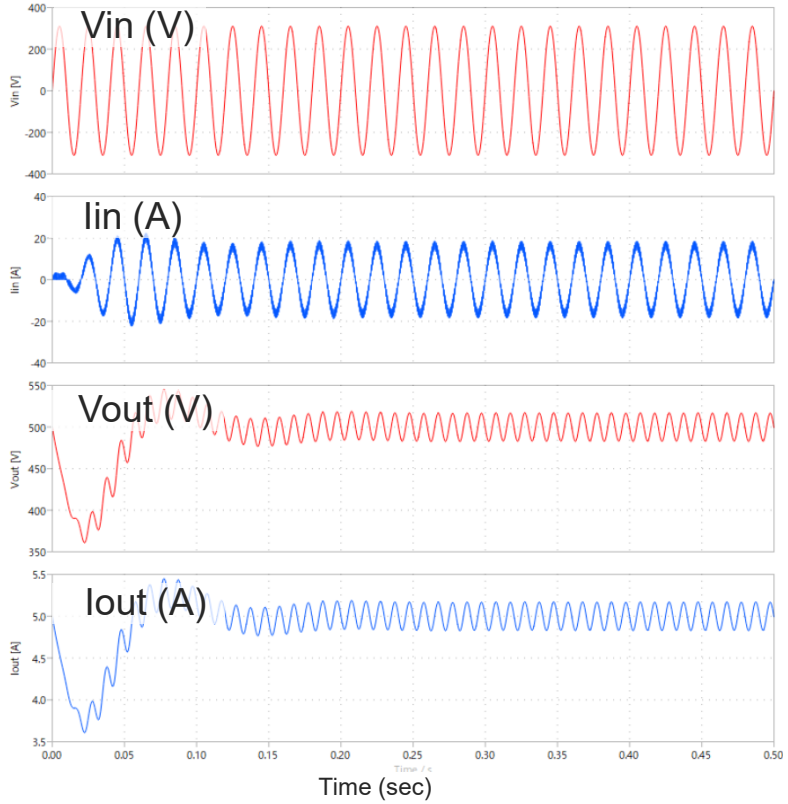
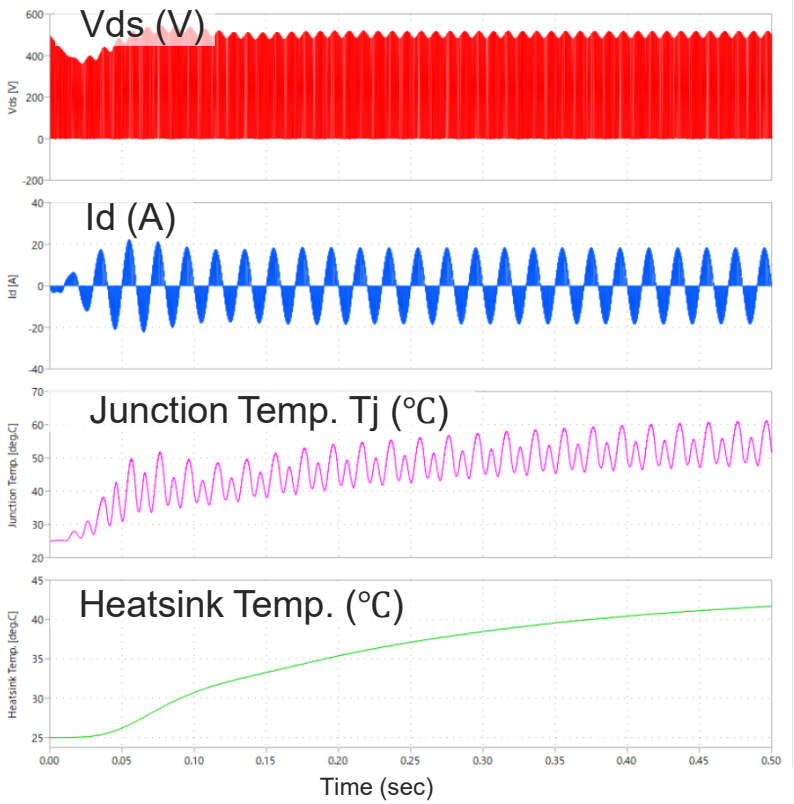
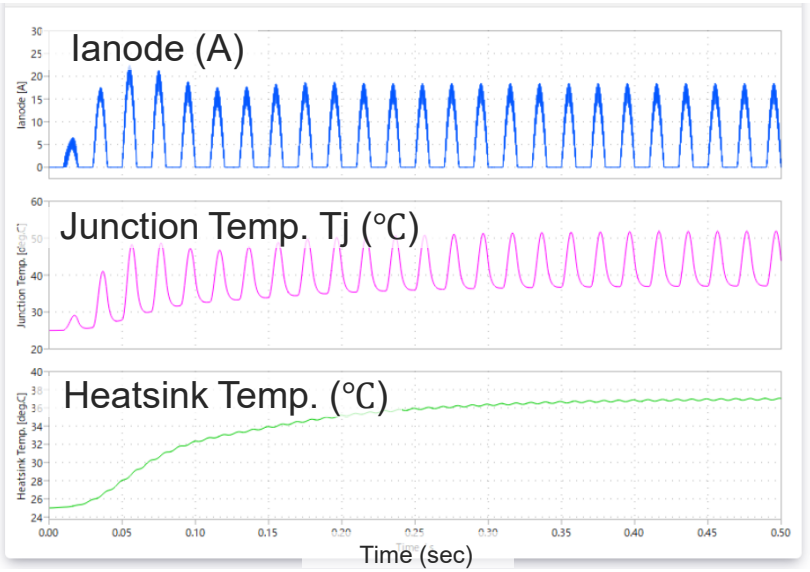
Input and Output



MOSFET (HF leg)



Diode (LF leg)



Contents	Results
Input Power : Pin	2533.70 (W)
Output Power: Pout	2502.09 (W)
Efficiency: η	98.75 (%)

Contents	Results
Junction Temp. Tj(mos)	47.45 (℃)
Heatsink Temp. T_hs(mos)	34.58 (℃)
Conduction Loss: Pcond(mos)	5.63 (W/device)
Switching Loss: Psw(mos)	4.10 (W/device)
Total Loss: Ptot(mos)	19.46 (W)

Contents	Results
Junction Temp. Tj(diode)	36.29 (℃)
Heatsink Temp. T_hs(diode)	31.04 (℃)
Conduction Loss: Pcond(diode)	6.01 (W/device)
Total Loss: Ptot(diode)	12.02 (W)

How to change the devices

The figure of “(A-011-D) DC-AC Totem-Pole PFC Diode Rectification (Discrete)” is used as an example in this page.

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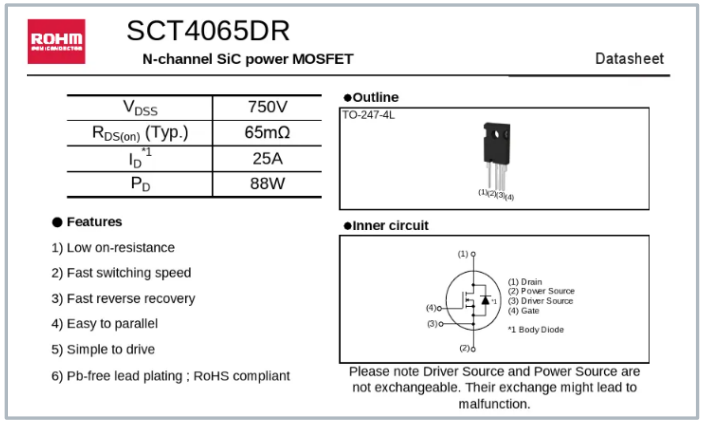
You can select the simulation devices at “Step-2: Device Selection”

Please check the checkboxes of the devices you want to simulate (Square checkboxes allow you to select up to three devices simultaneously.)

You can also select IDEAL devices (no-loss) .

In addition, clicking PDF icon will allow you to view the datasheet of the certain device.



SCT4065DR

N-channel SiC power MOSFET

Datasheet

V_{DSS}	750V
$R_{DS(on)}$ (Typ.)	65mΩ
I_D *1	25A
P_D	88W

● Features

1) Low on-resistance
2) Fast switching speed
3) Fast reverse recovery
4) Easy to parallel
5) Simple to drive
6) Pb-free lead plating ; RoHS compliant

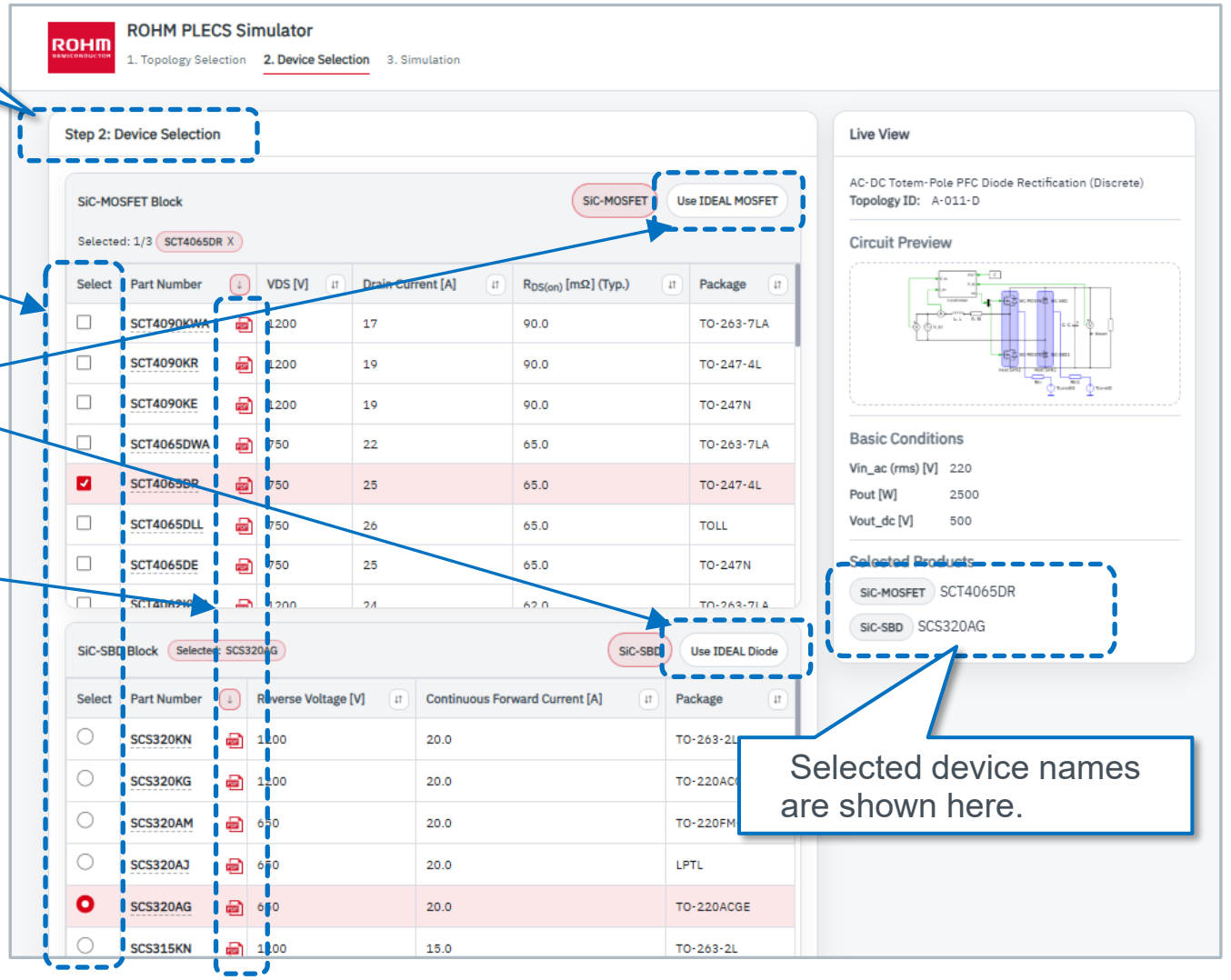
●Outline

TO-247-4L

●Inner circuit

(1) Drain
(2) Power Source
(3) Driver Source
(4) Gate
*1 Body Diode

Please note Driver Source and Power Source are not exchangeable. Their exchange might lead to malfunction.



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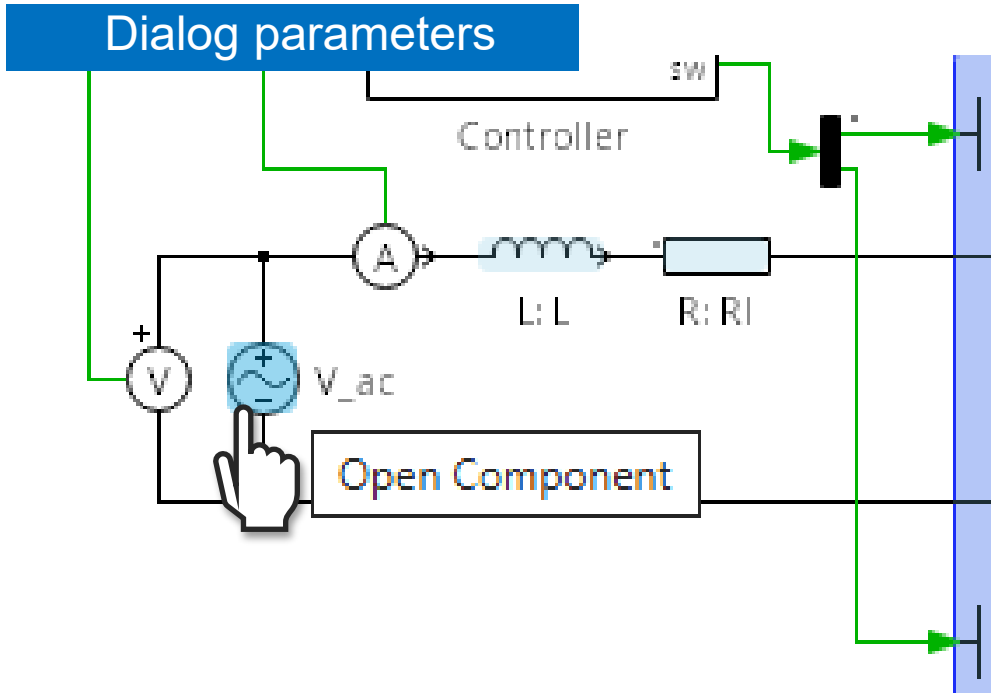
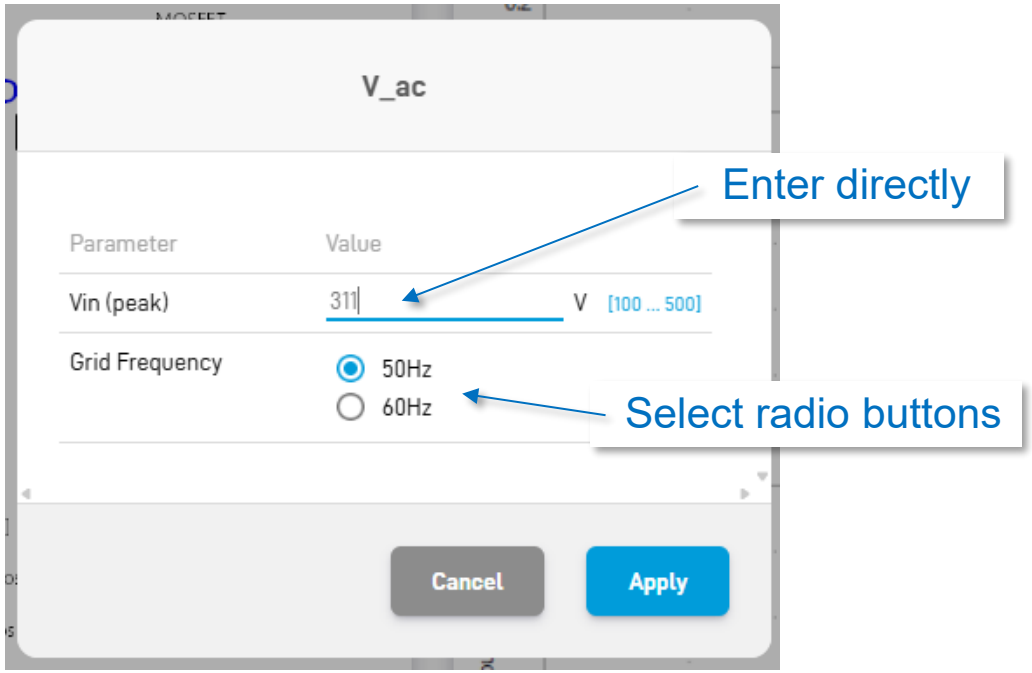
How to change Dialog parameters

- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. “V_ac” symbol in the below).
- Click the left button of the mouse.



- A new window like the below is opened.
- You can change the parameters by entering the value directly* or selecting radio buttons.
- Push “Apply” button after changing all parameters.



*Note: Parameters can be entered directly are limited by Min. and Max. values to avoid unexpected system errors.
(e.g. “Vin(peak)” is limited between 100 and 500V in the above.)

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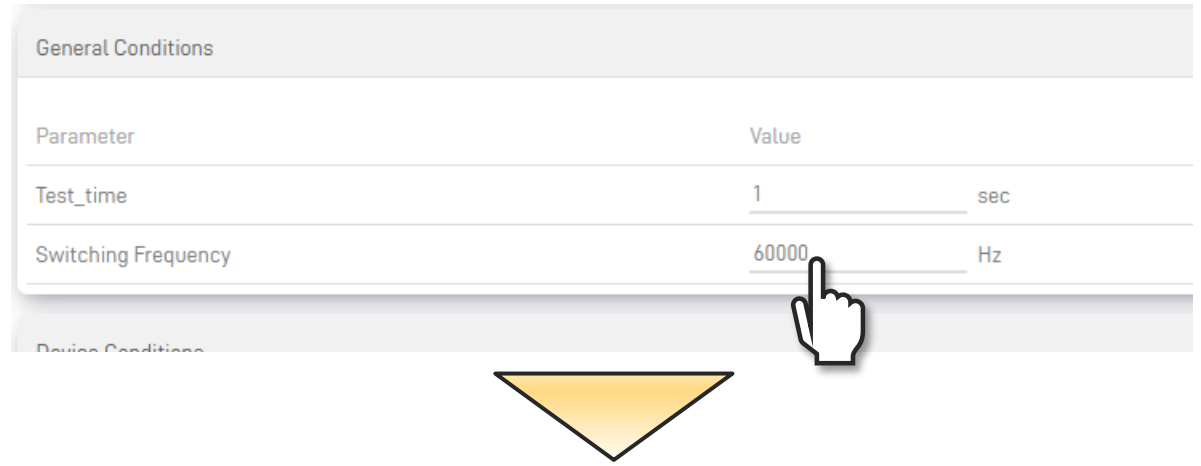
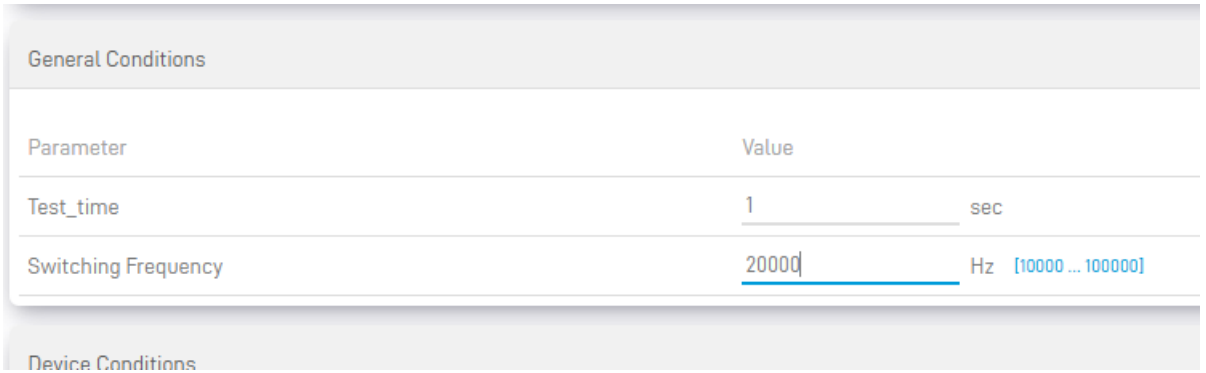
How to change Table parameters

Table parameters





Choose the parameter that you want change on the parameter tables (e.g. ”60kHz” of Switching Frequency in the left figure.)

- A blue under-line and variable range of the parameter are appeared.
- Then, you can change the parameters by entering the value directly ” (e.g. “60kHz” was changed to “20kHz”).

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