

(A-021-DOT) DC-AC 3-Phase Vienna PFC (DOT247)

Simulation Parameters (Dialog)

Name	Content	unit	Default Value	Variable Range
L1~3	Inductive Load	H	470u	1n ~ 1
R2~4	Choke Resistance	Ω	5m	1u ~ 100m
C1,C2	Output Capacitor Initial Voltage	F V	1m 400	1n ~ 1 0 ~ 1200
Thcap_MOSFET	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_MOSFET	Thermal Resistance	K/W	1	1m ~ 100
TGND_MOSFET	Thermal GND Temperature	°C	25	-40 ~ 175
Thcap_Diode	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_Diode	Thermal Resistance	K/W	1	1m ~ 100
TGND_Diode	Thermal GND Temperature	°C	25	-40 ~ 175

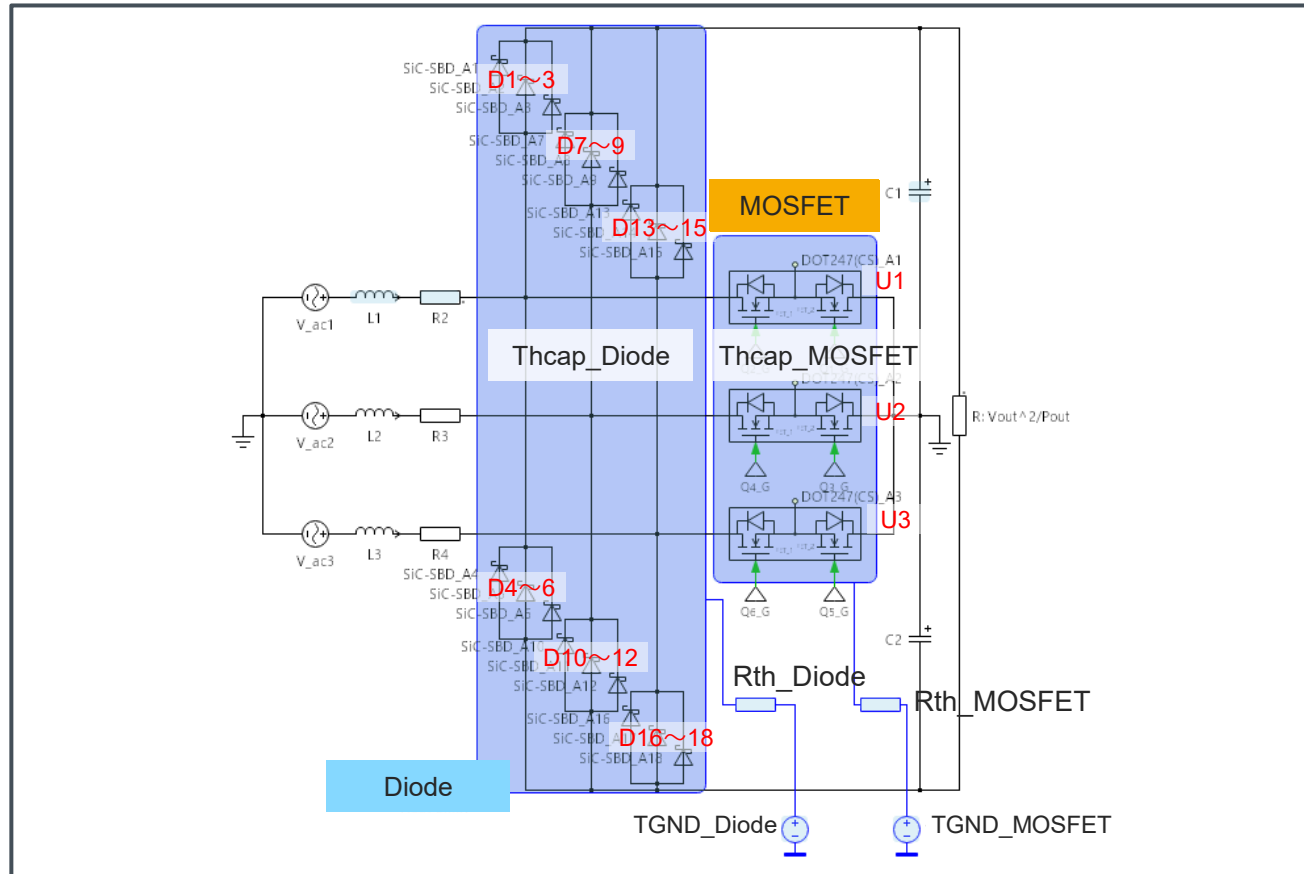
Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.5	100u ~ 0.5
fs	Switching Frequency	Hz	12k	10k ~ 100k
Vin_ac (rms)	Input Voltage (Peak Voltage) Grid Frequency	V Hz	220 50	100 ~ 500 50 or 60
Vout_dc	Output Voltage	V	800	300 ~ 1200
Pout	Output Power	W	25000	100 ~ 33000
Rg_on*	Gate Resistance (Source)	Ω	15	0.1 ~ 100
Rg_off*	Gate Resistance (Sink)	Ω	15	0.1 ~ 100
T_init**	Initial Junction Temp.	°C	25	-40 ~ 175

*Same value for all MOSFETs

**Same value for all devices

Simulation Circuit



Power Devices

Name	Device Type	Part No.	Specification
U1~3	SiC MOSFET Module	SCZ4004DTB	750V/ 251A/ 4mΩ/ DOT247(Common Source)
D1~18	SiC SBD*	SCS320KG	1200V/ 20A/ TO-220ACGE

*SBD:Schottky Barrier Diode

Schematic window

- Dialog parameters setting
- Results display

The screenshot displays the PLECS simulation environment. At the top left is the schematic window showing a power MOSFET circuit with various components like diodes, resistors, and capacitors. Below the schematic are tables for 'Diode', 'MOSFET', and 'Others' parameters. To the right of the schematic are four waveform plots: Vm [V], Im [A], Vout [V], and Iout [A]. Below the waveforms is a 'Simulation Control' panel with buttons for 'Start-Up', 'Steady-state', and 'Hold Result'. Underneath is a 'Traces' panel showing the selected trace. At the bottom left is a 'Table parameters setting' window with a table for device conditions. At the bottom right are two more waveform plots: Junction Temp. [deg.C] and Heatsink Temp. [deg.C].

Clicking blue-colored symbols will allow you to change the parameters.

Simulation Control: Start-Up, Steady-state, Hold Result, Simulation Completed

Traces: [file:SC24004DTB].SCS320KG (1200V/20A/TD-220ACGE), Trace 1

Parameter	Value	Unit
Rg_on	15	ohm
Rg_off	15	ohm
Initial Junction Temperature	25	deg.C

Waveforms

Simulation control

Trace selection

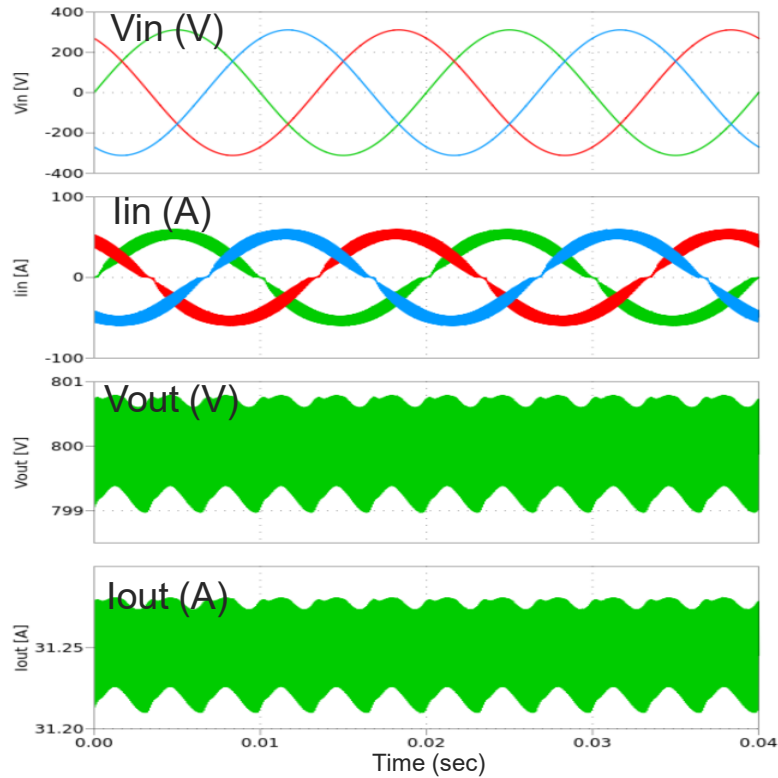
Table parameters setting

Simulation Results

Simulation Mode: Steady State

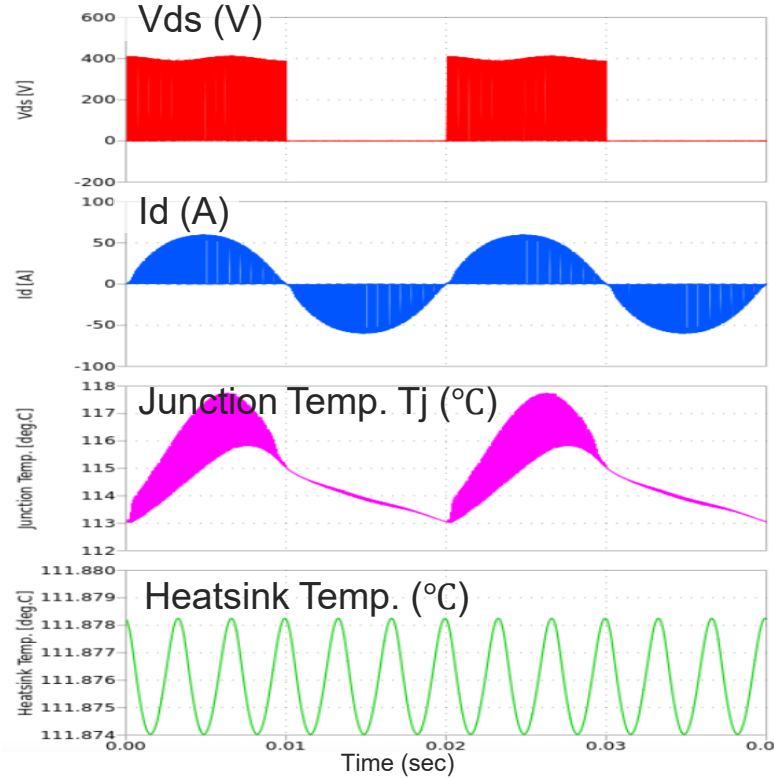
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Input and Output



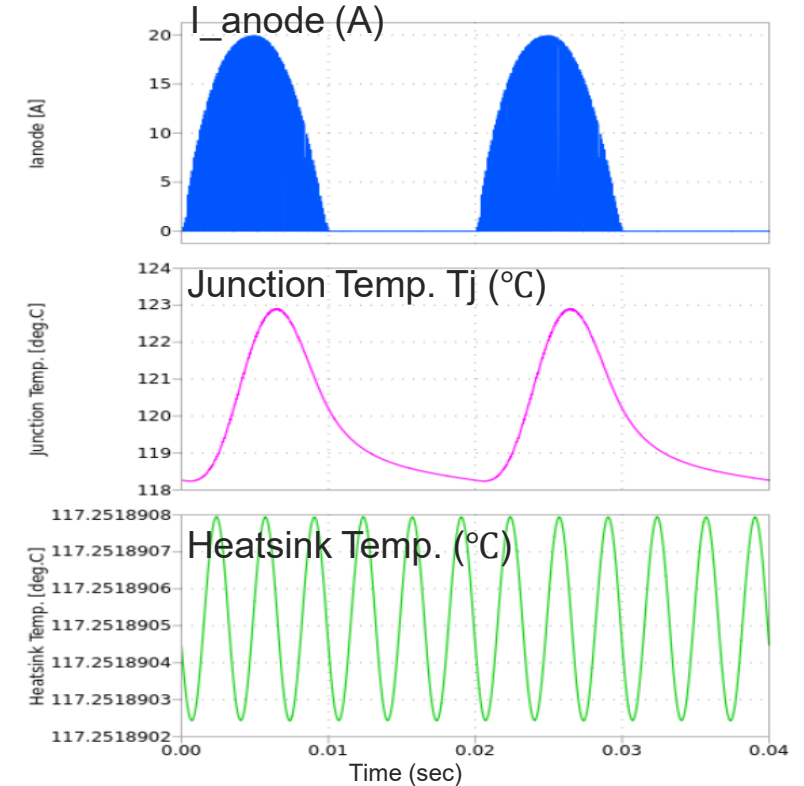
Contents	Results
Input Power : Pin	25.202 (kW)
Output Power: Pout	25.000 (kW)
Efficiency: η	99.20 (%)

MOSFET



Contents	Results
Junction Temp. Tj(mosfet)	114.42 (°C)
Heatsink Temp. T_hs(mosfet)	111.88 (°C)
Conduction Loss: Pcond(mosfet)	3.50 (W/device)
Switching Loss: Psw(mosfet)	10.98 (W/device)
Total Loss: Ptot (mosfet)	86.88 (W)

Diode



Contents	Results
Junction Temp. Tj(diode)	119.77 (°C)
Heatsink Temp. T_hs(diode)	117.25 (°C)
Conduction Loss: Pcond(diode)	5.13 (W/device)
Total Loss: Ptot(diode)	97.25 (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.

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

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.

SIC-MOSFET Block

Selected: 1/3 **SCT4065DR X**

Select	Part Number	VDS [V]	Drain Current [A]	R _{DS(on)} [mΩ] (Typ.)	Package
<input type="checkbox"/>	SCT4090KWA	200	17	90.0	TO-263-7LA
<input type="checkbox"/>	SCT4090KR	200	19	90.0	TO-247-4L
<input type="checkbox"/>	SCT4090KE	200	19	90.0	TO-247N
<input type="checkbox"/>	SCT4065DWA	750	22	65.0	TO-263-7LA
<input checked="" type="checkbox"/>	SCT4065DR	750	25	65.0	TO-247-4L
<input type="checkbox"/>	SCT4065DLL	750	26	65.0	TOLL
<input type="checkbox"/>	SCT4065DE	750	25	65.0	TO-247N
<input type="checkbox"/>	SCT4065DK	200	24	62.0	TO-263-7LA

SIC-SBD Block

Selected: SCS320AG

Select	Part Number	Reverse Voltage [V]	Continuous Forward Current [A]	Package
<input type="radio"/>	SCS320KN	1000	20.0	TO-263-2L
<input type="radio"/>	SCS320KG	1000	20.0	TO-220AC
<input type="radio"/>	SCS320AM	600	20.0	TO-220FM
<input type="radio"/>	SCS320AJ	600	20.0	LPTL
<input checked="" type="radio"/>	SCS320AG	600	20.0	TO-220ACGE
<input type="radio"/>	SCS315KN	1000	15.0	TO-263-2L

Selected Products

- SIC-MOSFET SCT4065DR
- SIC-SBD SCS320AG

Selected device names are shown here.

SCT4065DR
N-channel SiC power MOSFET

V _{DSS}	750V
R _{DS(on)} (Typ.)	65mΩ
I _D ⁻¹	25A
P _D	88W

Features

- Low on-resistance
- Fast switching speed
- Fast reverse recovery
- Easy to parallel
- Simple to drive
- Pb-free lead plating ; RoHS compliant

How to change Dialog parameters

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

ROHM PLECS Simulator
Simulation Example

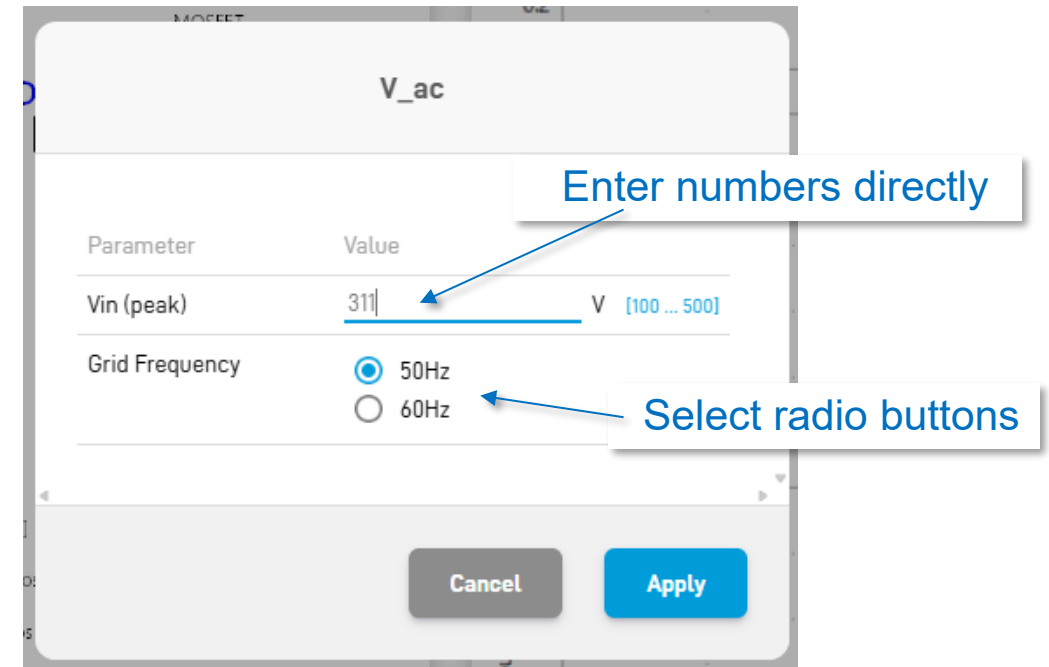


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- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. "V_ac" symbol in the below).
- Click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



- 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.)

How to change Table parameters

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

ROHM PLECS Simulator
Simulation Example



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Table parameters

General Conditions

Parameter	Value
Test_time	1 sec
Switching Frequency	60000 Hz

Device Conditions

General Conditions

Parameter	Value
Test_time	1 sec
Switching Frequency	<u>20000</u> Hz [10000 ... 100000]

Device Conditions

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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