

# (C-006-D) DC-DC Buck Converter (Discrete)

## Simulation Parameters (Dialog)

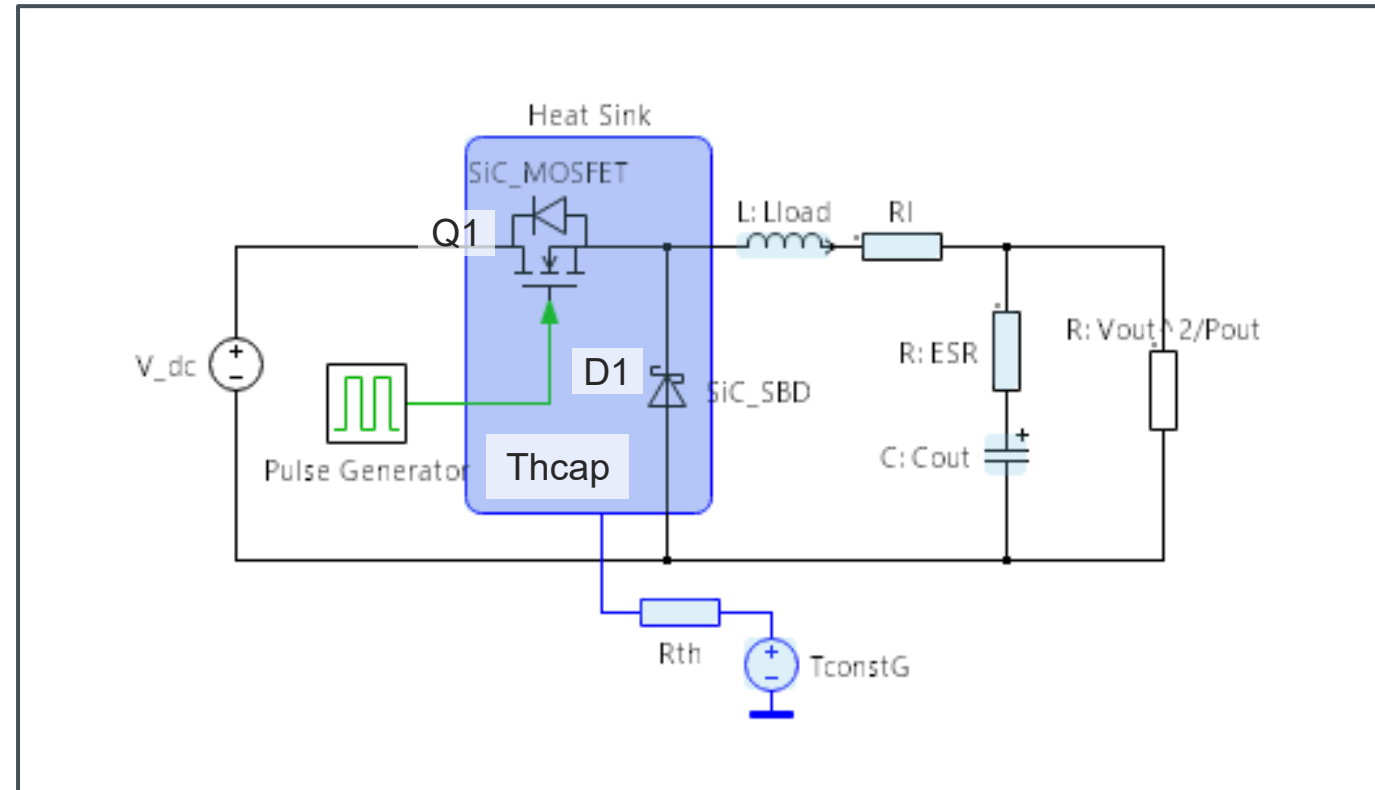
Name	Content	unit	Default Value	Variable Range
L	Inductive Load	H	470μ	1n ~ 1
RI	Parasitic Resistance	Ω	5m	1u ~ 100m
Cout	Output Capacitor	F	100u	1n ~ 1
Vc_init	Initial Voltage of Cout	V	48	0 ~ 1200
ESR	Equivalent Series Resistance	Ω	10m	1u ~ 100m
Rth	Thermal Resistance	K/W	0.5	1m ~ 100
Thcap	Thermal Capacitance	J/K	0.1	1m ~ 1000
TGND	Thermal GND Temperature	°C	25	-40 ~ 175

## Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.3	100u ~ 0.5
fs	Switching Frequency	kHz	50	10k ~ 100k
Vin	Input Voltage	V	400	10~ 1200
Vout	Output Voltage	V	48	10 ~ 1200
Pout	Output Power	W	1k	1~10k
Rg_on	Gate Resistance (Source)	Ω	6.8	0 ~ 100
Rg_off	Gate Resistance (Sink)	Ω	6.8	0 ~ 100
T_init	Initial Junction Temperature	°C	25	-40 ~ 175

## Simulation Circuit

2026 May  
68UG112E Rev.002



## Power Devices

Name	Device Type	Part No.	Specification
Q1	SiC MOSFET	SCT4013DR	750V/ 105A/ 13mΩ/ TO-247-4L
D1	SiC Schottky Barrier Diode	SCS320AG	650V/ 20A/ TO-220ACGE

# Simulation Screen Overview

Schematic window  
• Dialog parameters setting  
• Results display

Simulation control

Trace selection

Table parameters setting

The screenshot displays the ROHM PLECS Simulator interface, which is divided into several functional areas:

- Schematic window (top left):** Shows a circuit diagram of a power MOSFET switching circuit. It includes a pulse generator, a MOSFET, a diode, and various passive components like inductors and capacitors. A text box above the schematic states: "Clicking blue-colored symbols will allow you to change the parameters." Below the schematic are sections for "Input / Output", "Electrical", "Thermal", and "Input / Output Loss".
- Simulation control (middle left):** Contains buttons for "Start-Up", "Steady-state", and "Hold Result", along with a "Simulation Completed" indicator.
- Traces (bottom left):** Shows a list of selected traces, including "[file:SCT4013DR], SCS320AG (650V/20A/TO-220ACGE), Trace 1".
- Results display (right side):** Displays multiple plots:
  - Vin [V]:** A plot showing a constant input voltage of approximately 400V.
  - Iin [A]:** A plot showing a constant input current of approximately 20A.
  - Vout [V]:** A plot showing a constant output voltage of approximately 45V.
  - Iout [A]:** A plot showing a constant output current of approximately 20A.
  - SIC MOSFET Vd [V]:** A plot showing the drain-source voltage of the MOSFET, which is constant at approximately 400V.
  - HeatSink Temp [deg C]:** A plot showing the heat sink temperature, which rises from 25 deg C to approximately 30 deg C over time.
- Table parameters setting (bottom):** A table for setting device parameters:
 

Parameter	Value	Unit
Pout	1000	W
Rg_on	6.8	ohm
Rg_off	6.8	ohm
Initial Junction Temperature	25	deg C

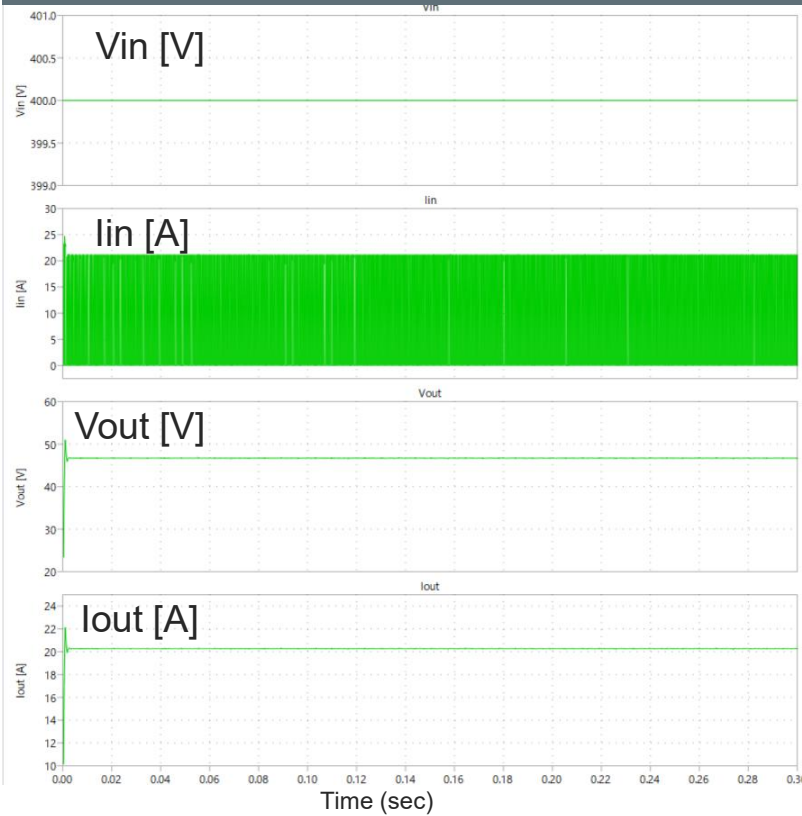
Waveforms

# Simulation Results

Simulation Mode: Start-UP

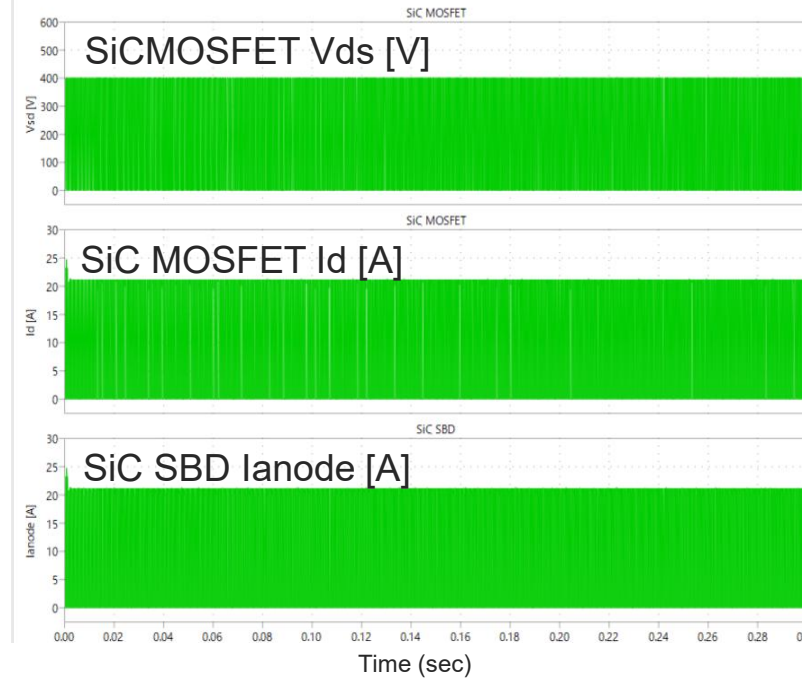
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## Input and Output



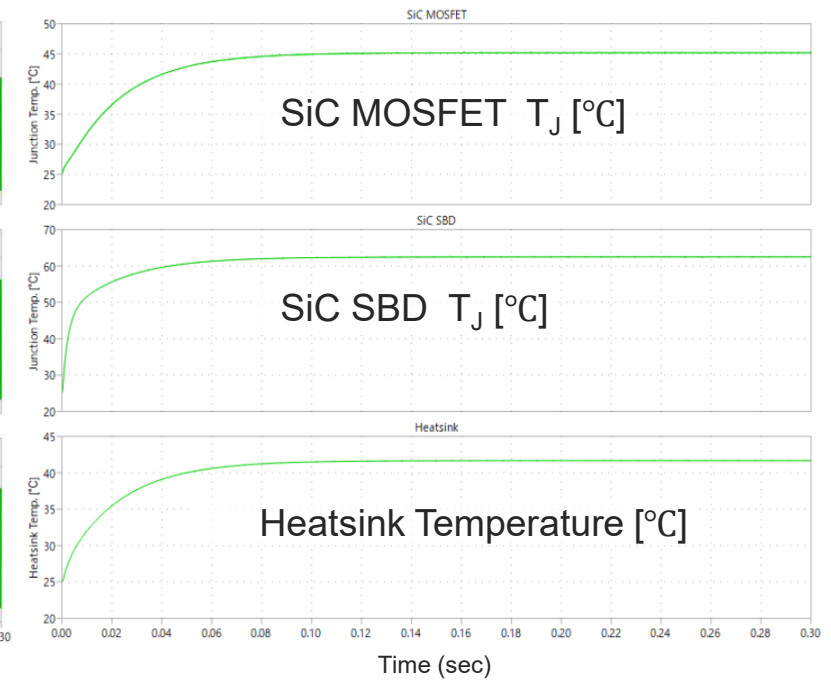
Contents	Results
Input Power : Pin	962.79 W
Output Power: Pout	946.82 W
Efficiency: $\eta$	98.34 %

## Electrical



Contents	Results
Conduction Loss (SiC MOSFET)	0.74 W
Switching Loss (SiC MOSFET)	12.29 W
Total Loss (SiC MOSFET)	13.03 W
Conduction Loss (SiC SBD)	0.88 W
Loss (Others)	2.06 W

## Thermal



Contents	Results
Tj (SiC MOSFET)	48.17 °C
Tj (SiC SBD)	64.28 °C
T_Heatsink	43.44 °C

# 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 <sub>DS(on)</sub> [mΩ] (Typ.)	Package
<input type="checkbox"/>	SCT4090KWA	1200	17	90.0	TO-263-7LA
<input type="checkbox"/>	SCT4090KR	1200	19	90.0	TO-247-4L
<input type="checkbox"/>	SCT4090KE	1200	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	1200	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	1100	20.0	TO-263-2L
<input type="radio"/>	SCS320KG	1100	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	1100	15.0	TO-263-2L

**Selected Products**

- SIC-MOSFET SCT4065DR
- SIC-SBD SCS320AG

**Live View**

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

**Circuit Preview**

**Basic Conditions**

V<sub>in\_ac</sub> (rms) [V] 220  
P<sub>out</sub> [W] 2500  
V<sub>out\_dc</sub> [V] 500

Selected device names are shown here.

**SCT4065DR**  
N-channel SiC power MOSFET

Parameter	Value
V <sub>DSS</sub>	750V
R <sub>DS(on)</sub> (Typ.)	65mΩ
I <sub>D</sub> <sup>-1</sup>	25A
P <sub>D</sub>	88W

**Features**

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

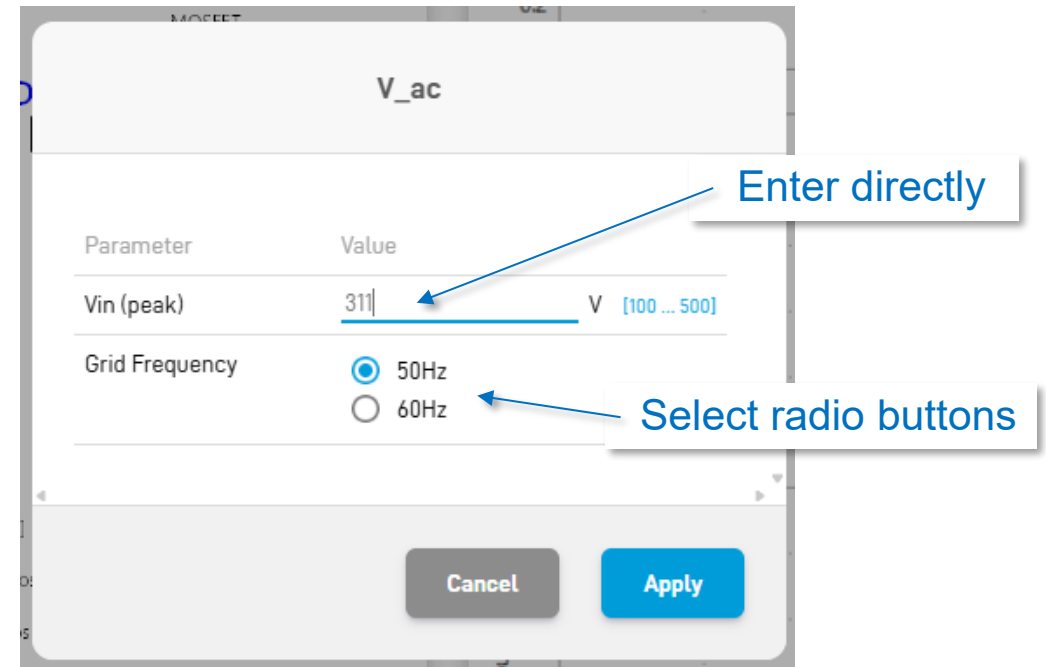
# How to change Dialog parameters

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

- 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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