

# (C-019-DOT) DC-DC Phase-Shift Full-Bridge Buck Converter (DOT247)

## Simulation Parameters (Dialog)

Name	Content	unit	Default Value	Variable Range
Transformer	Np: Primary-turns	turns	20	1 ~ 1000
	Ns: Secondary-turns	turns	18	1 ~ 1000
	Lm: Magnetizing Inductance	H	1m	1n~1
Lr	Leakage Inductance	H	6.8u	1n ~ 1
Lout	Output Inductance	H	330u	1n ~ 1
Cout	Output Capacitance	F	47u	1n ~ 1
Vc_init	Initial Voltage of Cout	V	300	0 ~ 1200
Rp	Parasitic Resistance (Primary)	ohm	5m	1n ~ 100
Rs	Parasitic Resistance (Secondary)	ohm	5m	1n ~ 100
Primary	Thcap_Primary	Thermal Capacitance	J/K	0.1 ~ 100
	Rth_Primary	Thermal Resistance	K/W	0.3 ~ 100
	TGND_Primary	Thermal GND Temperature	°C	-40 ~ 175
Secondary	Thcap_Secondary	Thermal Capacitance	J/K	0.1 ~ 100
	Rth_Secondary	Thermal Resistance	K/W	0.3 ~ 100
	TGND_Secondary	Thermal GND Temperature	°C	-40 ~ 175

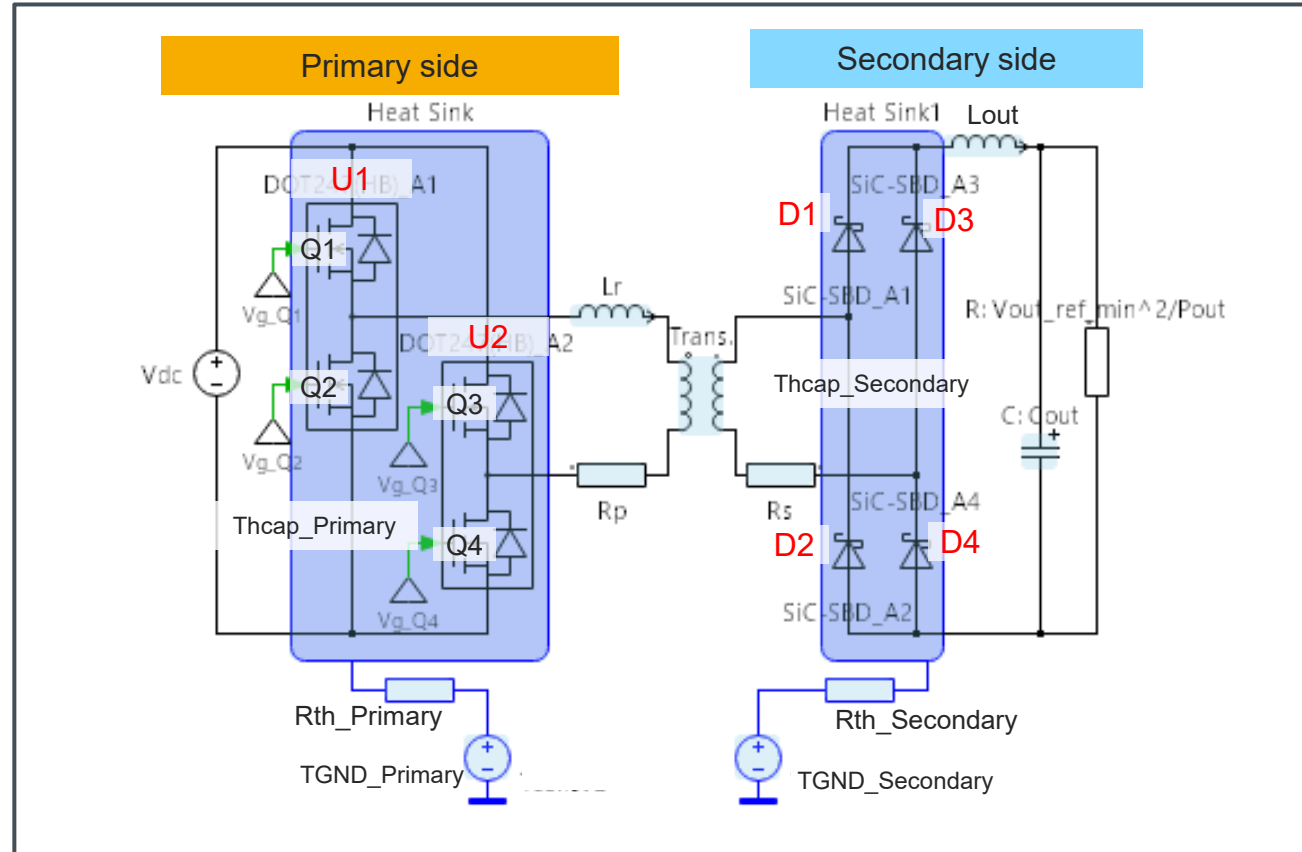
## Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.15	100u ~ 0.5
fs	Switching Frequency	Hz	30k	10k ~ 100k
Vin	Input Voltage	V	400	100 ~ 1200
Vout_ref_min Vout_ref_max	Output Voltage	V	300 320	10 ~ 1200
Pout	Output Power	W	5000	100 ~ 10000
Rg_on*	Gate Resistance (Source)	Ω	15	0.1 ~ 100
Rg_off*	Gate Resistance (Sink)	Ω	15	0.1 ~ 100
DT	Dead Time	s	100n	0 ~ 1m
T_init**	Initial Junction Temp.	°C	25	-40 ~ 175

\*Common for all MOSFETs

\*\*Common for all devices

## Simulation Circuit



## Power Devices

Name	Device Type	Part No.	Specification
U1, U2	SiC MOSFET module	SCZ4008DTA	750V/ 134A/ 8mΩ/ DOT247
D1~4	SiC SBD***	SCS320AG	650V/ 20A/ TO-220ACGE

\*\*\* SBD: Schottky Barrier Diode

**Schematic window**

- Dialog parameters setting
- Results display

**Simulation control**

**Trace selection**

**Table parameters setting**

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

**Input/Output**

5067.72	Pin [W]
5000.00	Pout [W]
98.66	Efficiency : η [%]

**Primary MOSFET Module**

1.18	Conduction Loss [W/device]
4.18	Switching Loss [W/device]
33.46	Junction Temp. [°C]

**Secondary Diode**

46.64	Junction Temp. (Secondary) [°C]
37.53	T_heatsink (Secondary) [°C]
41.77	Total Loss (Secondary) [W]

**Others**

2.55	Loss (Others) [W]
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**Total**

31.71	T_heatsink (Primary) [°C]
22.39	Total Loss (Primary) [W]

**Simulation Control**

Start-Up    Steady-state    Hold Result    Simulation Completed

**Traces**

[file:SCZ4008D0TA], SCS320AG (650V/20A/TO-220ACGE), Trace 1

Switching Frequency	30000	Hz
Vin_dc	400	V
Vout_dc (Min.limit)	300	V
Vout_dc (Max.limit)	320	V
Pout	5000	W

**Waveforms**

Input Current [A]

Output Voltage [V]

Output Current [A]

Primary MOSFET

Inductor Current [A]

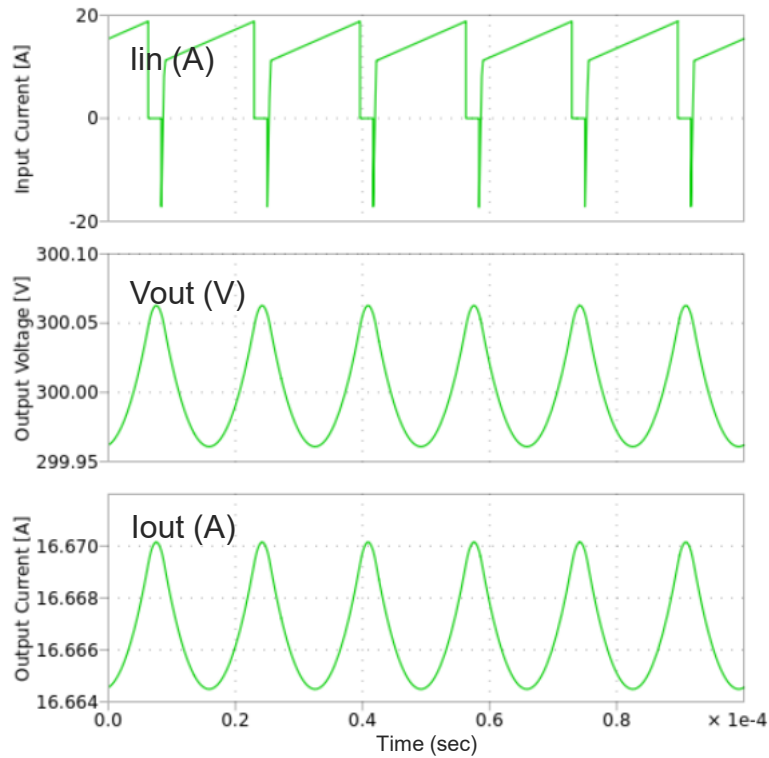
Heatsink Temp. [deg.]

**Waveforms**

# Simulation Results 1

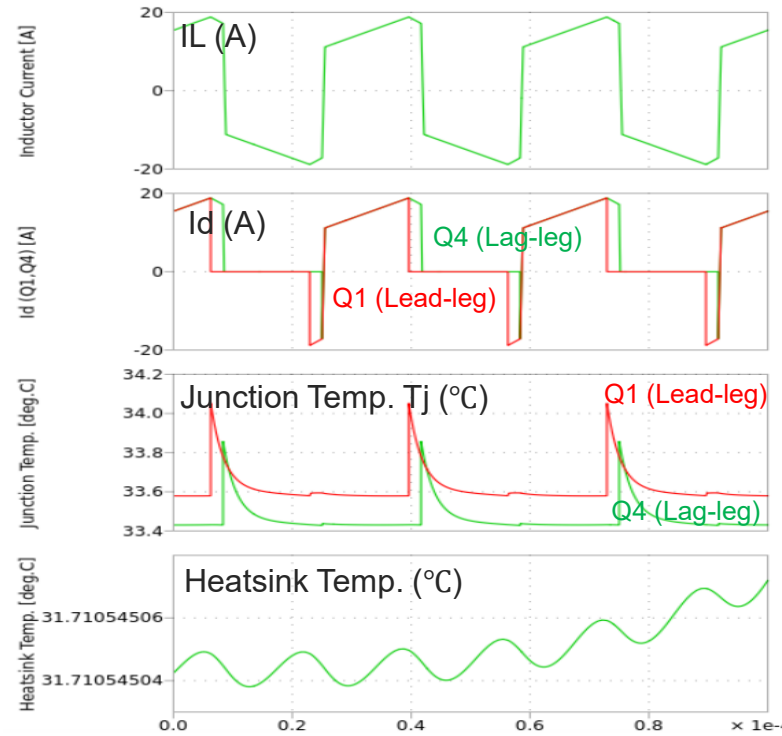
## Simulation Mode: Steady State

### Input and Output



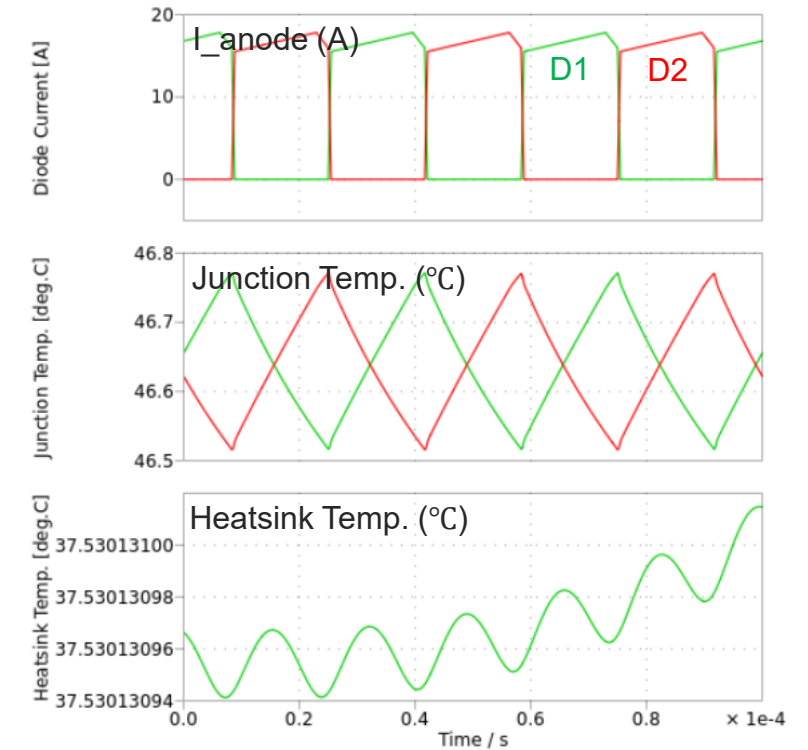
Contents	Results
Input Power : Pin	5.067 (kW)
Output Power: Pout	5.000 (kW)
Efficiency: $\eta$	98.66 (%)

### Primary side



	Contents	Results
Q4 Lag-leg	Conduction Loss: Pcond (Q4)	1.18 (W/device)
	Switching Loss: Psw (Q4)	4.18 (W/device)
	Junction Temp. : Tj (Q4)	33.46 (°C)
Q1 Lead-leg	Conduction Loss: Pcond (Q1)	1.22 (W/device)
	Switching Loss: Psw (Q1)	4.62 (W/device)
	Junction Temp. : Tj (Q1)	33.62 (°C)
	Heatsink Temp.: T_hs (primary)	31.71 (°C)
	Total Loss: Ptot (primary)	22.39 (W)

### Secondary side



	Contents	Results
	Junction Temp. Tj (secondary D1,D2)	46.64 (°C)
	Heatsink Temp. T_hs (secondary)	37.53 (°C)
	Total Loss: Ptot (secondary)	41.77 (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 SCS320AG

Select	Part Number	VDS [V]	Drain Current [A]	R <sub>DS(on)</sub> [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 SCS320AG
- SIC-SBD SCS320AG

Selected device names are shown here.

**SCT4065DR**  
N-channel SiC power MOSFET

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

**Outline**  
TO-247-4L

**Inner circuit**

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

# 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

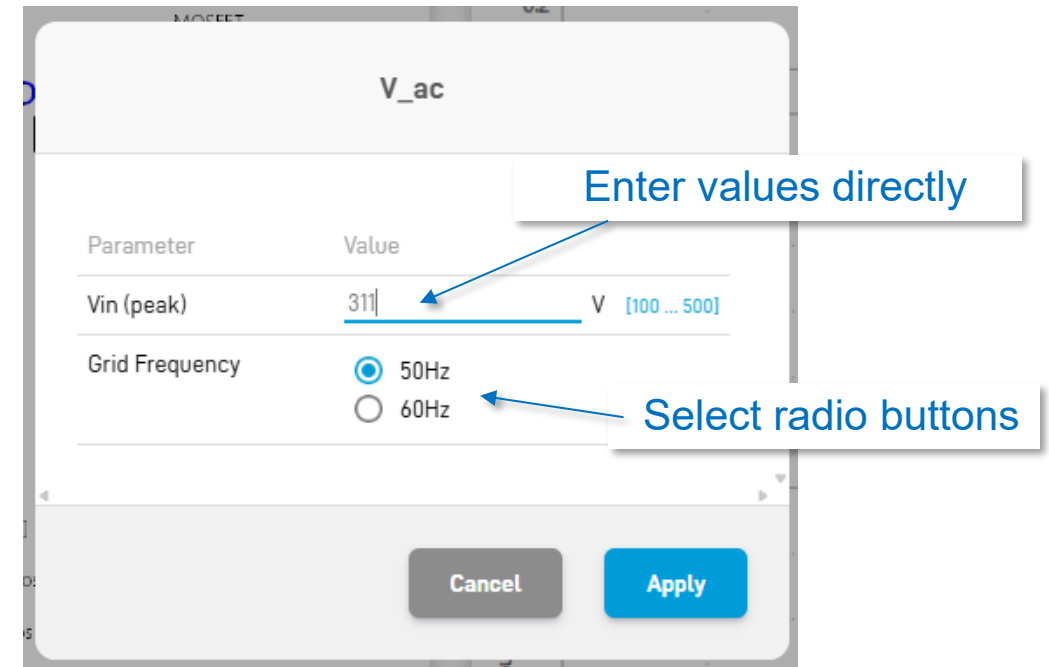


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- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. "V\_ac" symbol in the below).
- Click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

## 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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