

(C-011-D) DC-DC Forward Converter (Discrete)

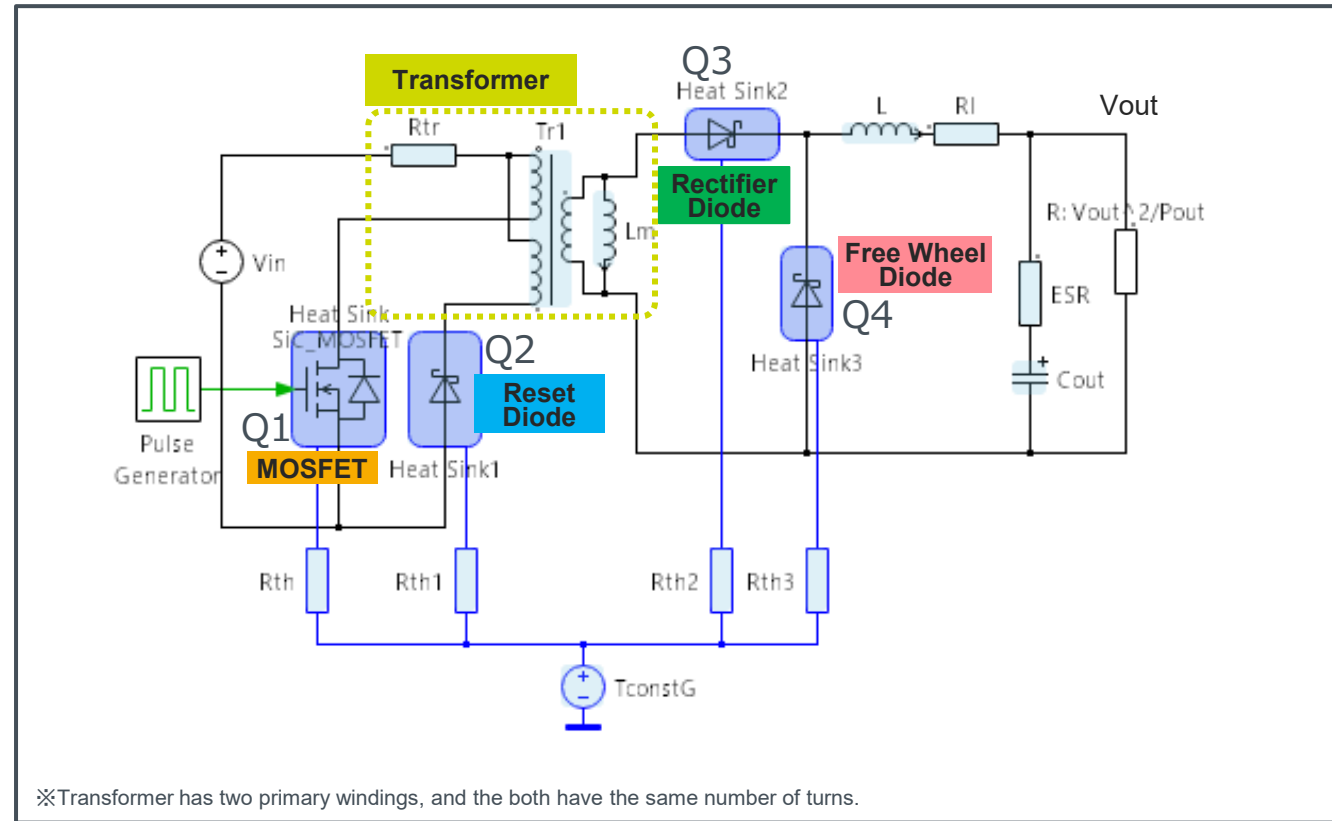
Simulation Parameters (Dialog)

Name	Content	unit	Default Value	Variable Range
Cout	Output Capacitor	F	500u	1n ~ 1
ESR	ESR of Cout	Ω	3m	1n ~ 1
L	Inductive Load	H	300u	1n ~ 1
RI	Choke Resistance	Ω	100m	1m ~ 100
Lm	Magnetizing Inductance	H	2m	1n ~ 1
Np	Number of Primary windings	turns	3	1~100
Ns	Number of Secondary windings	turns	1	1~100
Rtr	Parasitic Resistance	Ω	100m	1m ~ 100
Thcap_mos	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_mos	Thermal Resistance	K/W	0.5	1m ~ 100
Thcap_rst	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_rst	Thermal Resistance	K/W	0.5	1m ~ 100
Thcap_rec	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_rec	Thermal Resistance	K/W	0.5	1m ~ 100
Thcap_fw	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_fw	Thermal Resistance	K/W	0.5	1m ~ 100
TGND	Thermal GND Temperature	$^{\circ}\text{C}$	25	-40 ~ 175

Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.4	100u ~ 0.5
fs	Switching Frequency	kHz	100	10 ~ 1000
Vin	Input Voltage	V	300	100~ 1200
Vout	Output Voltage	V	48	5 ~ 1000
Pout	Output Power	W	500	10~100k
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	$^{\circ}\text{C}$	25	-40 ~ 175

Simulation Circuit



Power Devices

Name	Device Type	Part No.	Specification
Q1	SiC MOSFET	SCT4065DR	750V/25A/65m Ω /TO-247-4L
Q2~4	SiC Schottky Barrier Diode	SCS320AG	650V/20A/TO-220ACGE

Schematic window

- Dialog parameters setting
- Results display

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

Input/Output

Pin [W]	499.86
Pout [W]	473.37
η [%]	94.70

Primary-Side

Junction Temp (mosfet) [deg.C]	33.41
Heatsink Temp (mosfet) [deg.C]	27.30
Conduction Loss (mosfet) [W]	0.43
Switching Loss (mosfet) [W]	3.78
Junction Temp (rst) [deg.C]	25.02
Heatsink Temp (rst) [deg.C]	25.01
Loss (rst) [W]	0.01

Secondary-Side

Junction Temp (rec) [deg.C]	32.68
Heatsink Temp (rec) [deg.C]	27.80
Loss (rec) [W]	5.60
Junction Temp (fw) [deg.C]	33.01
Heatsink Temp (fw) [deg.C]	27.92
Loss (fw) [W]	5.84

SIC Total Loss (mosfet+SBD)

Total Loss (mosfet+SBD) [W]	15.65
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Other Loss

Loss (Other) [W]	10.34
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Simulation Control

Start-Up Steady-state Hold Result Simulation Completed

Traces

[file:SCT4065DR] SCS320AG (650V/20A/TO-220ACGE), SCS320AG (650V/2I)

Table parameters setting

Parameter	Value	Unit
Rg_on	6.8	ohm
Rg_off	6.8	ohm
Initial Junction Temperature	25	deg.C

Waveforms

Vin [V]

Iin [A]

Vout [V]

Iout [A]

Vds(mosfet) [V]

Id (fw)[A]

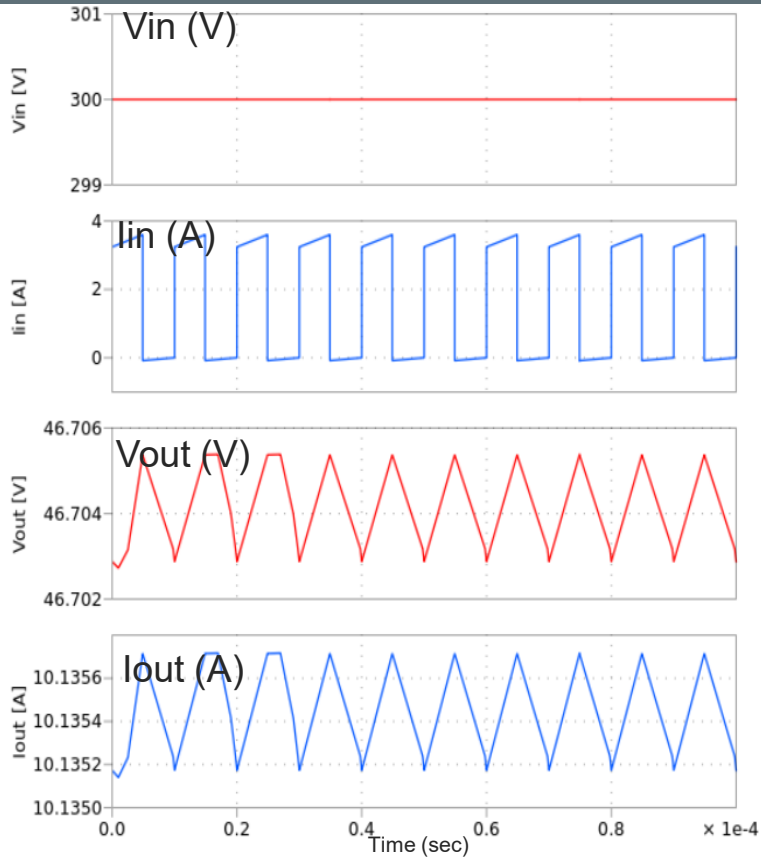
Temp (fw) [deg.C]

Simulation control

Trace selection

Table parameters setting

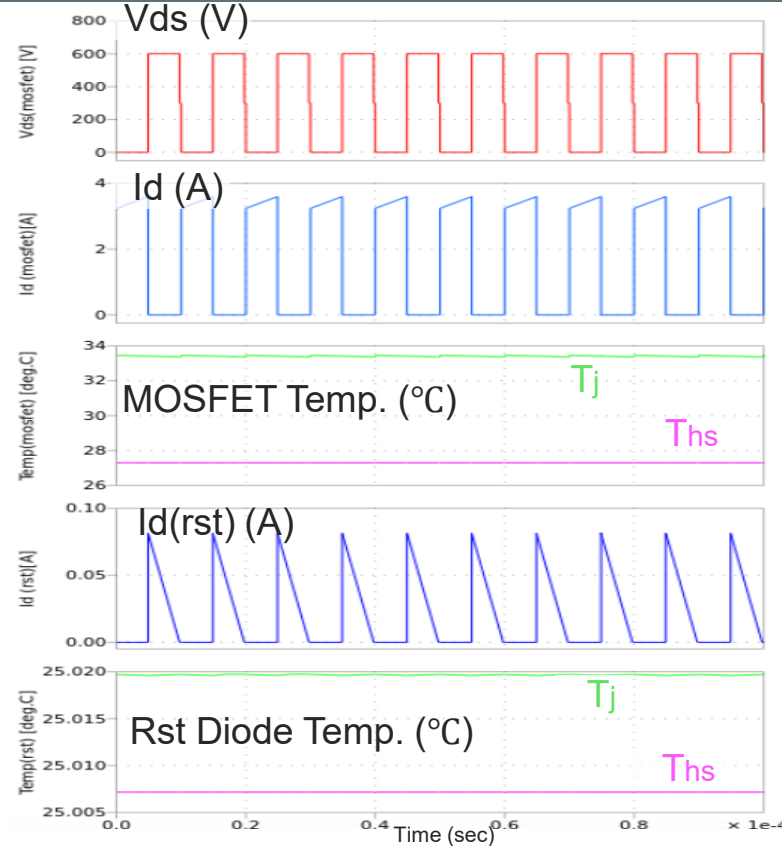
Input and Output



Contents	Results
Input Power : P_{in}	499.86(W)
Output Power: P_{out}	473.37 (W)
Efficiency: η	94.70 (%)

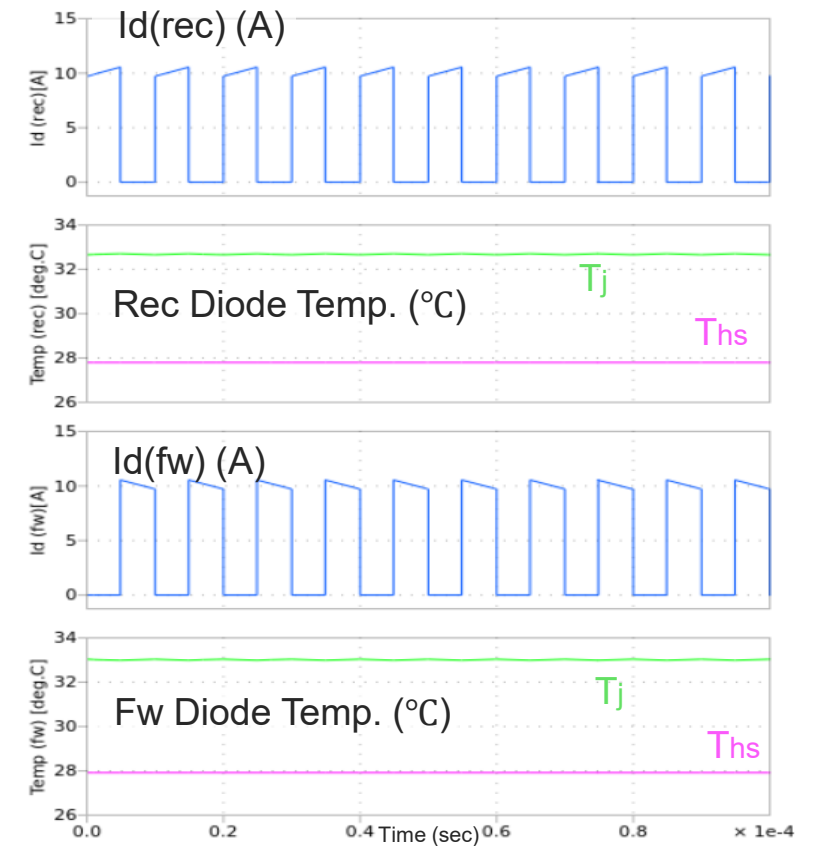
Contents	Results
Total Loss: P_{total} (mosfet+SBD)	15.65 (W)

Primary Side



Contents	Results
Junction Temp: T_j (mosfet)	33.41 (°C)
Heatsink Temp: T_{hs} (mosfet)	27.30 (°C)
Conduction Loss: P_{cond} (mosfet)	0.42 (W)
Switching Loss: P_{sw} (mosfet)	3.78(W)
Junction Temp : T_j (rst)	25.02(°C)
Heatsink Temp: T_{hs} (rst)	25.01(°C)
RST Diode Loss: $P_{cond}(rst)$	0.01(W)

Secondary Side



Contents	Results
Junction Temp : $T(fw)$	33.01(°C)
Heatsink Temp : T_{hs} (fw)	27.92(°C)
FW Diode Loss: $P_{cond}(fw)$	5.84 (W)
Junction Temp : $T(rec)$	32.68 (°C)
Heatsink Temp : T_{hs} (rec)	27.80 (°C)
REC Diode Loss: $P_{cond}(rec)$	5.60 (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"/>	SCT4065W	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

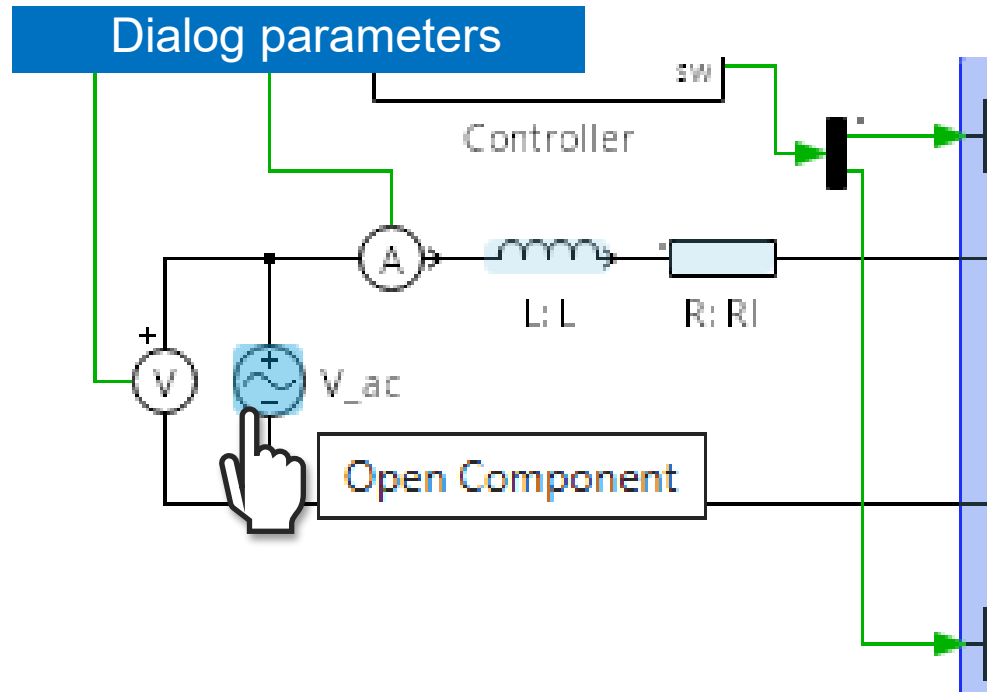
How to change Dialog parameters

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

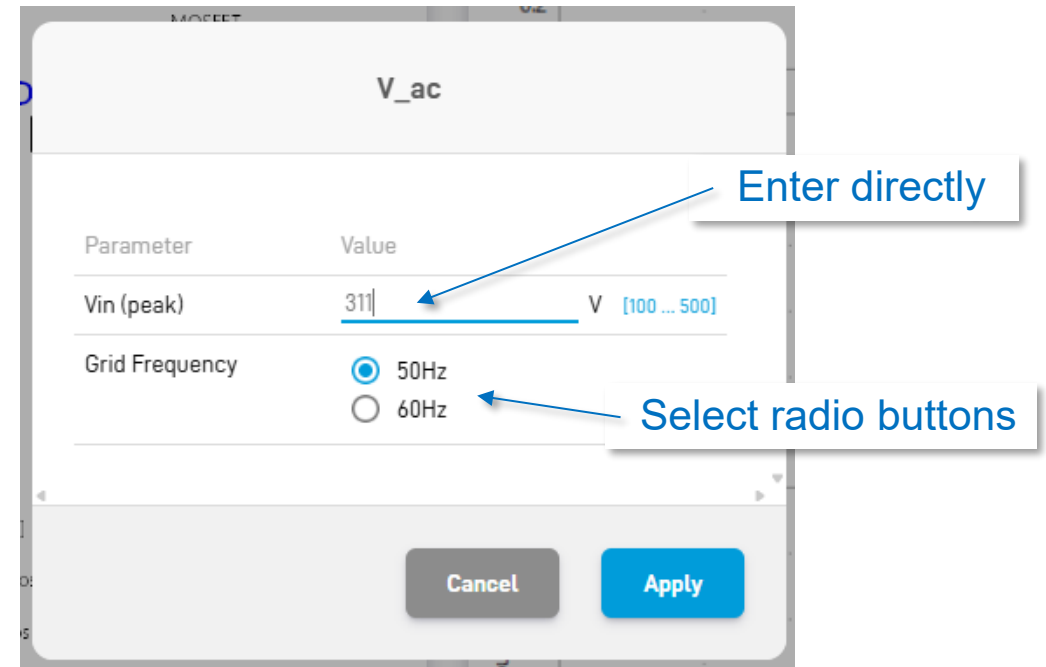
ROHM PLECS Simulator
Simulation Example



- 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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