

(C-014-DOT) DC-DC LLC Full-Bridge Converter (DOT247)

Simulation Parameters (Dialog)

Name	Content	unit	Default Value	Variable Range	
Transformer	Np: Primary-turns	turns	18	1 ~ 1000	
	Ns: Secondary-turns	turns	1	1 ~ 1000	
	Lm: Magnetizing Inductance	H	60u	1n~1	
Rp	Transformer Resistance	Ω	5m	1m ~ 1	
Rs	Transformer Resistance	Ω	1m	1m ~ 1	
Lr	Resonant Inductance	H	12u	1n ~ 1	
Cr	Resonant Capacitance	F	100n	1n ~ 1	
Cout	Output Capacitance	F	4.7m	1n ~ 1	
	Initial Voltage	V	50	0 ~ 80	
ESR	ESR of Cout	Ω	15m	1m ~ 1	
Primary	Thcap_Primary	Thermal Capacitance	J/K	0.1	1m ~ 100
	Rth_Primary	Thermal Resistance	K/W	0.1	1m ~ 100
	TGND_Primary	Ambient Temperature	$^{\circ}\text{C}$	25	-40 ~ 175
Secondary	Thcap_Secondary	Thermal Capacitance	J/K	0.1	1m ~ 100
	Rth_Secondary	Thermal Resistance	K/W	0.1	1m ~ 100
	TGND_Secondary	Ambient Temperature	$^{\circ}\text{C}$	25	-40 ~ 175

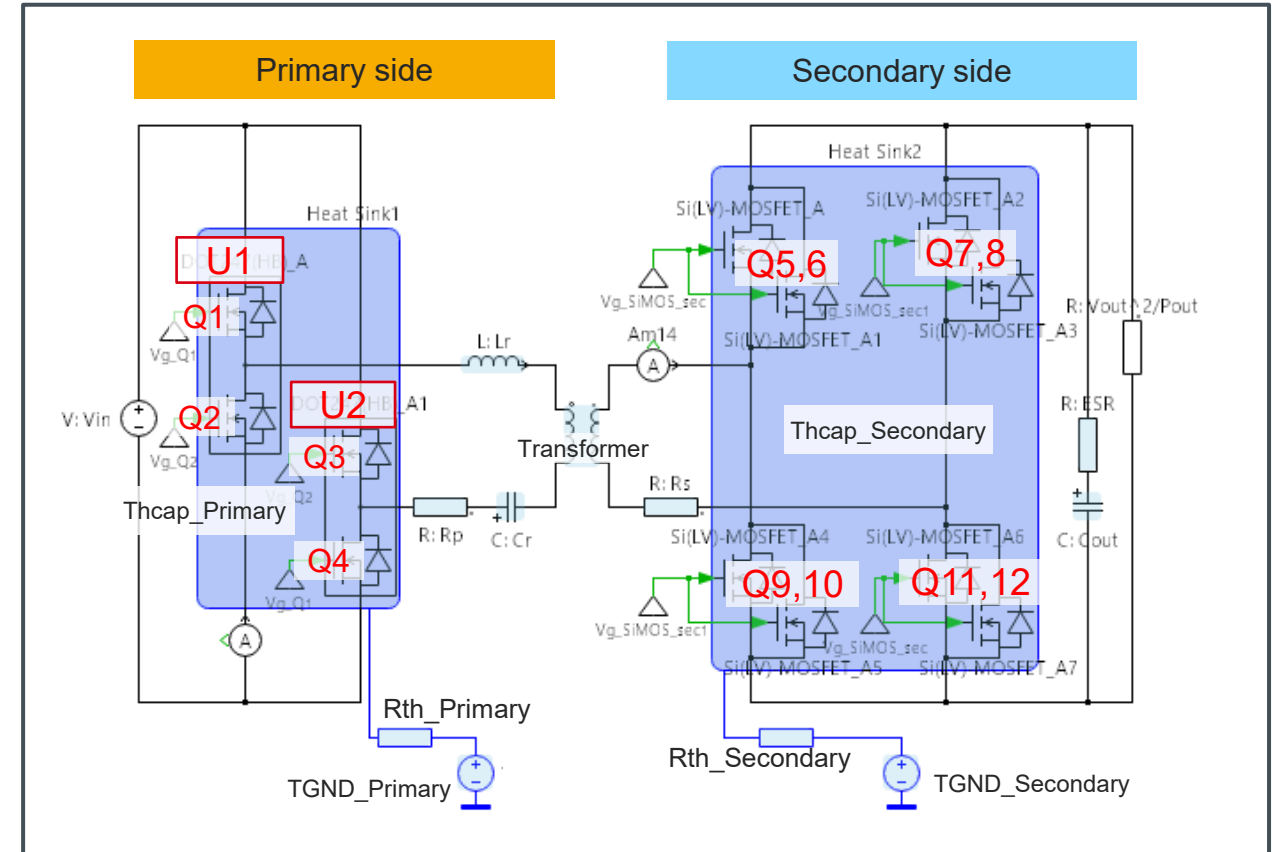
Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range	
Test_time	Test time in simulation	s	0.2	10u ~ 0.5	
Vin_dc	Input Voltage	V	800	400 ~ 1,200	
Vout_dc	Output Voltage	V	50	1 ~ 1200	
Pout	Output Power	W	10k	100~30k	
fs_ref	Target Carrier Frequency	Hz	100k	10k~500k	
Primary	Rg_on 1*	Gate Resistance (Source)	Ω	4.7	0.1 ~ 100
	Rg_off 1*	Gate Resistance (Sink)	Ω	2.0	0.1 ~ 100
	DT1	Dead Time	s	100n	0 ~ 1m
Secondary	Rg_on 2*	Gate Resistance (Source)	Ω	10	0.1 ~ 100
	Rg_off 2*	Gate Resistance (Sink)	Ω	10	0.1 ~ 100
	DT2	Dead Time	s	100n	0 ~ 1m
T_init**	Initial Junction Temp.	$^{\circ}\text{C}$	25	-40 ~ 175	

*Common for all MOSFETs in the same side.

**Common for all devices

Simulation Circuit



Default Devices

Name	Device Type	Part No.	Specification
U1,2	SiC MOSFET Module	SCZ4006KTA	1200V/ 209A/ 6m Ω / DOT247
Q5~12	Si MOSFET	RS7N200BH	80V/ 200A/ 1.7m Ω / DFN5060-8S

Schematic window

- Dialog parameters setting
- Results display

Device selection

Table parameters setting

Simulation control

Trace selection

Waveforms

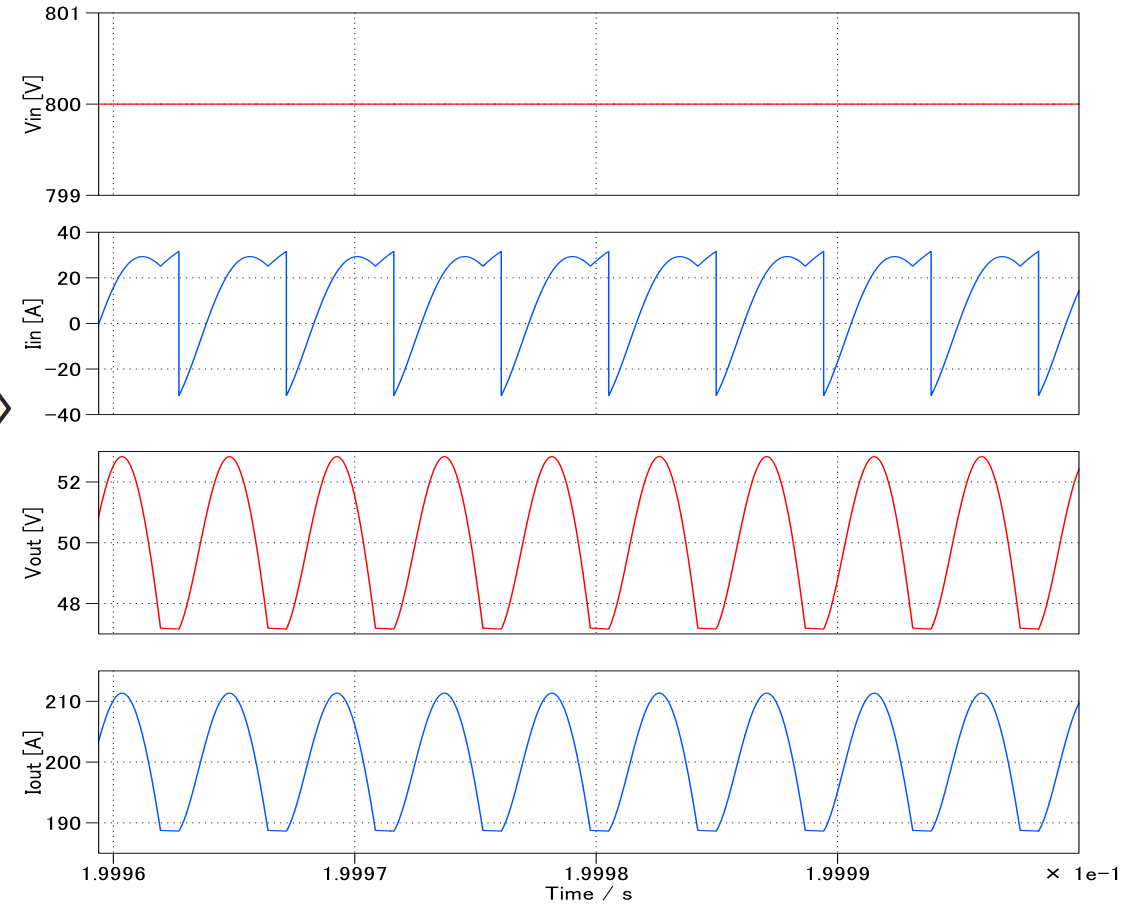
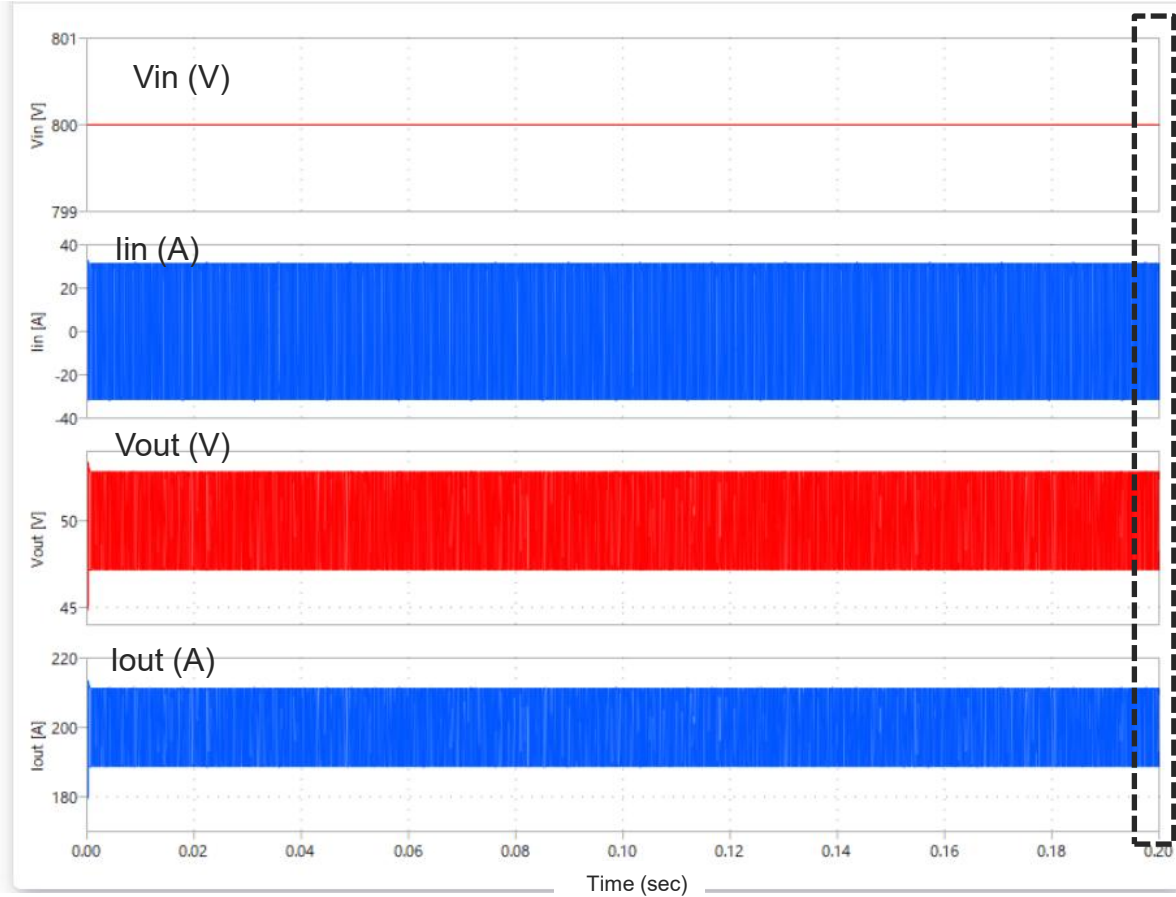
The screenshot displays the ROHM PLECS Simulator interface, which is divided into several key sections:

- Schematic Window:** Shows a detailed circuit diagram of a power converter, including MOSFETs, diodes, and an ILC controller. It includes input/output terminals and MOSFET primary/secondary components.
- Device Selection:** A dropdown menu for selecting MOSFET models. The selected model is SC2480BTA (750V 134A 8mD DOT247 Half-Bridge).
- Table Parameters Setting:** A table for configuring device conditions.

Parameter	Value
[Primary] Rg_on 1	4.7 ohm
[Primary] Rg_off 1	2 ohm
[Primary] Dead Time 1	1e-7 sec
[Secondary] Rg_on 2	10 ohm
[Secondary] Rg_off 2	10 ohm
[Secondary] Dead Time 2	1e-7 sec
Initial Junction Temperature	25 deg.C
- Simulation Control:** Includes buttons for 'Startup', 'Steady-state', and 'Hold Results'. The simulation is currently in the 'Steady-state' phase.
- Trace Selection:** A list of simulation traces, including 'JHE:SC2480BTA', 'RS7N208GH', and 'IBV1:7mCJ:DFN'. Trace 1 is selected.
- Waveforms:** Multiple plots showing simulation results over time (0.00 to 0.20 s). The plots include:
 - Input/Output voltage and current.
 - MOSFET primary and secondary gate and drain signals.
 - Temperature profiles for MOSFET primary and secondary junctions.

Simulation Results 1

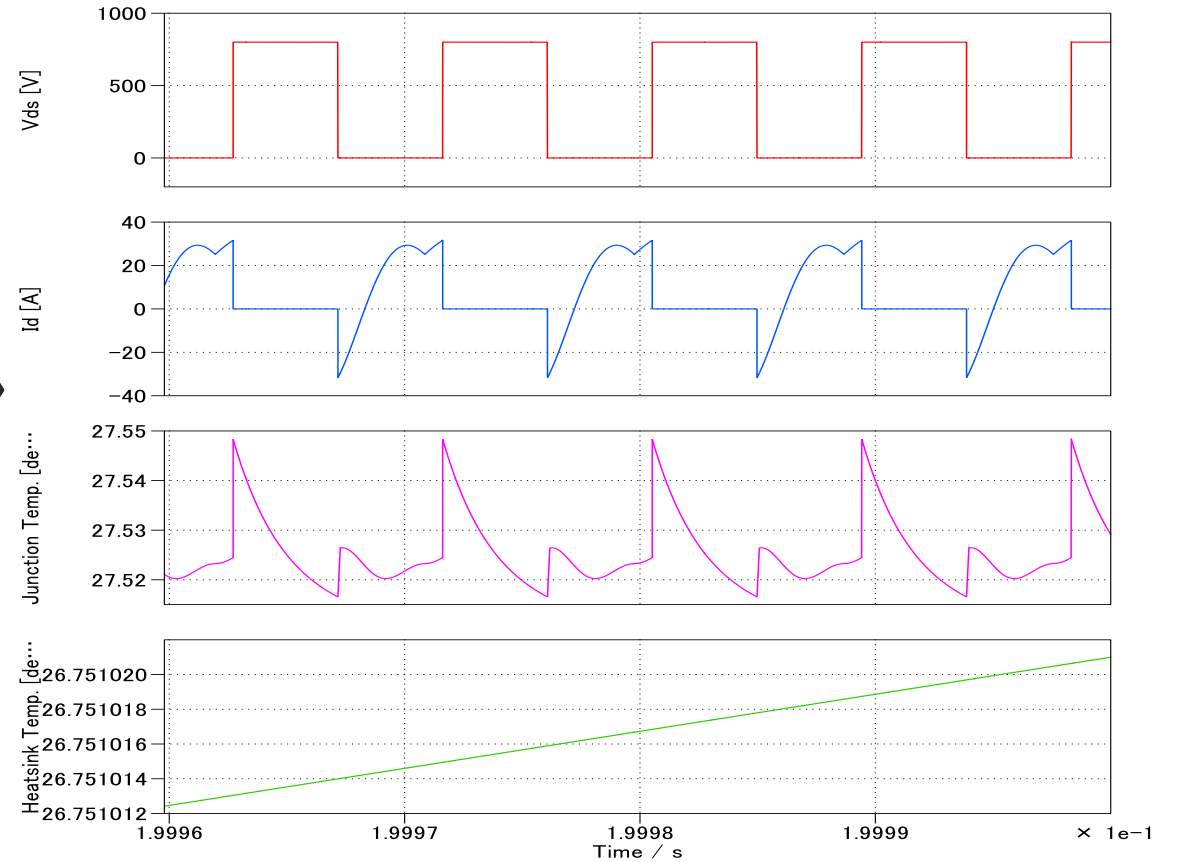
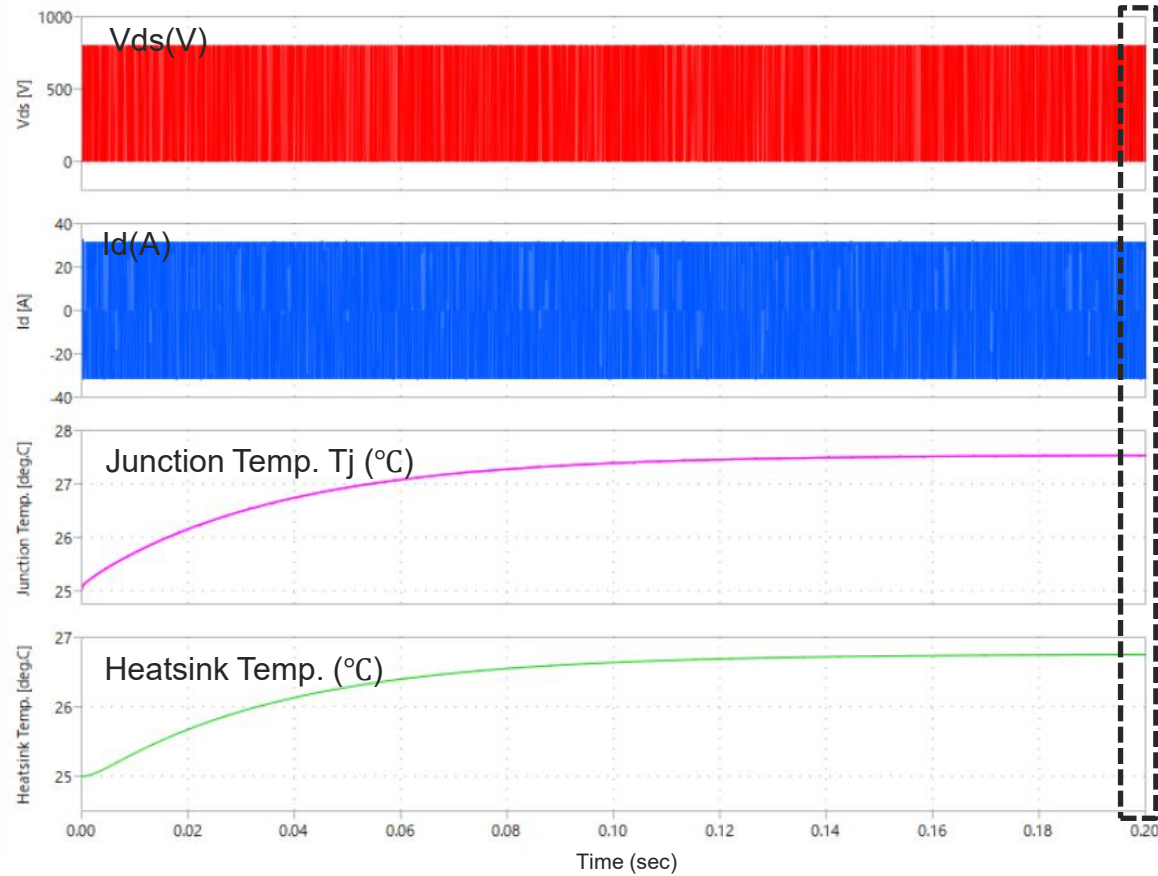
Input and Output



Contents	Results
Input Power : Pin	10.251 (kW)
Output Power: Pout	10.050 (kW)
Efficiency: η	98.04 (%)

Simulation Results 2

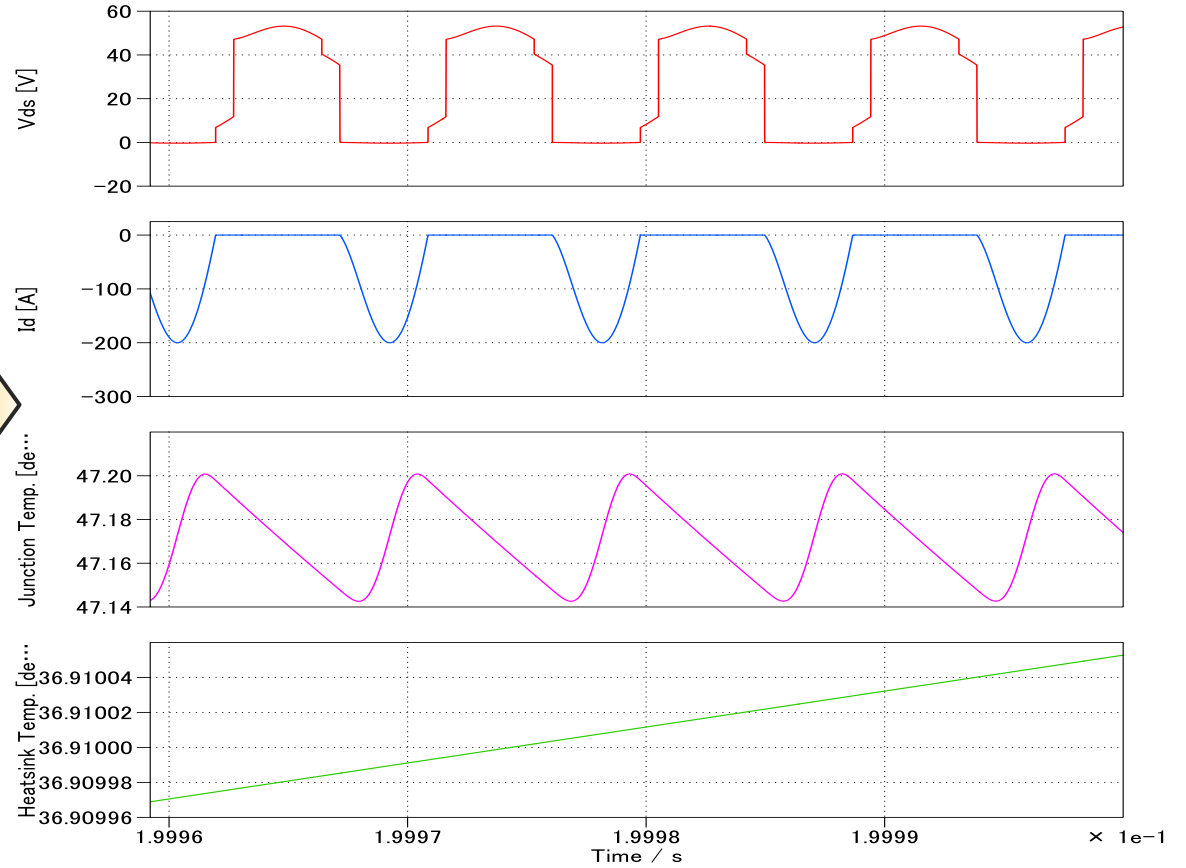
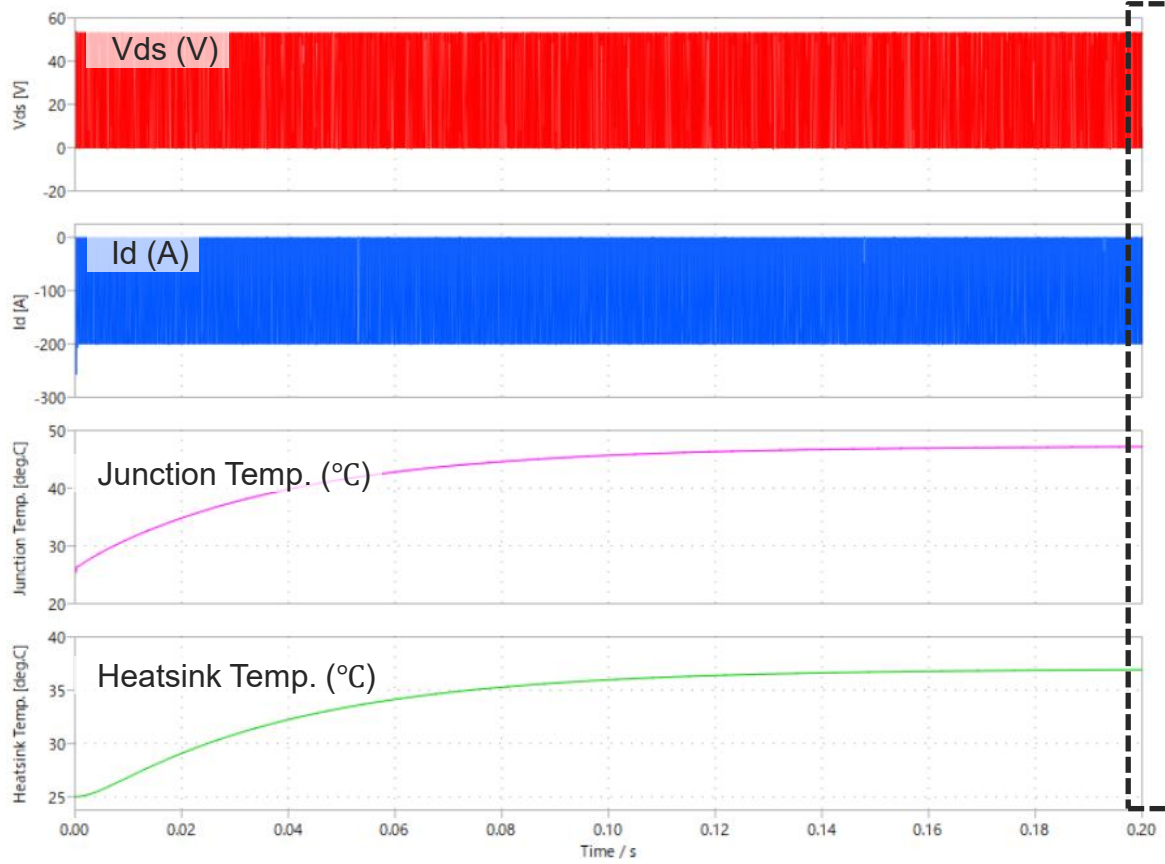
Primary side



Contents	Results
Conduction Loss: P_{cond} (primary)	2.47 (W/device)
Switching Loss: P_{sw} (primary)	2.03 (W/device)
Junction Temp. : T_j (primary)	27.53 (°C)
Heatsink Temp.: T_{hs} (primary)	25.75 (°C)
Total Loss: P_{tot} (primary)	17.99 (W)

Simulation Results 3

Secondary side

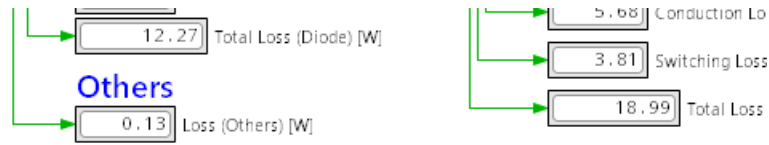


Contents	Results
Conduction Loss: Pcond (secondary)	14.67 (W/device)
Junction Temp. : Tj (secondary)	47.17 (°C)
Heatsink Temp.: T_hs (secondary)	36.91 (°C)
Total Loss: Ptot (secondary)	117.35 (W)

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.

Device Selection



Device Selection	
Parameter	Value
Part No. (SiC-MOSFET)	SCT4065DR (750V/65mΩ/TO-220...
Part No. (SiC-Schottky Barrier Diode)	SCS320AG (650V/20A/TO-220...



Device Selection	
Parameter	Value
Part No. (SiC-MOSFET)	SCT4065DR (750V/65mΩ/TO-220...
Part No. (SiC-Schottky Barrier Diode)	SCS320AG (650V/20A/TO-220...

- SCT4036DWA (750V/36mΩ/TO-263-7LA)
- SCT4045DWA (750V/45mΩ/TO-263-7LA)
- SCT4065DWA (750V/65mΩ/TO-263-7LA)
- SCT4013DLL (750V/13mΩ/TOLL)**
- SCT4026DLL (750V/26mΩ/TOLL)
- SCT4036DLL (750V/36mΩ/TOLL)
- SCT4045DLL (750V/45mΩ/TOLL)

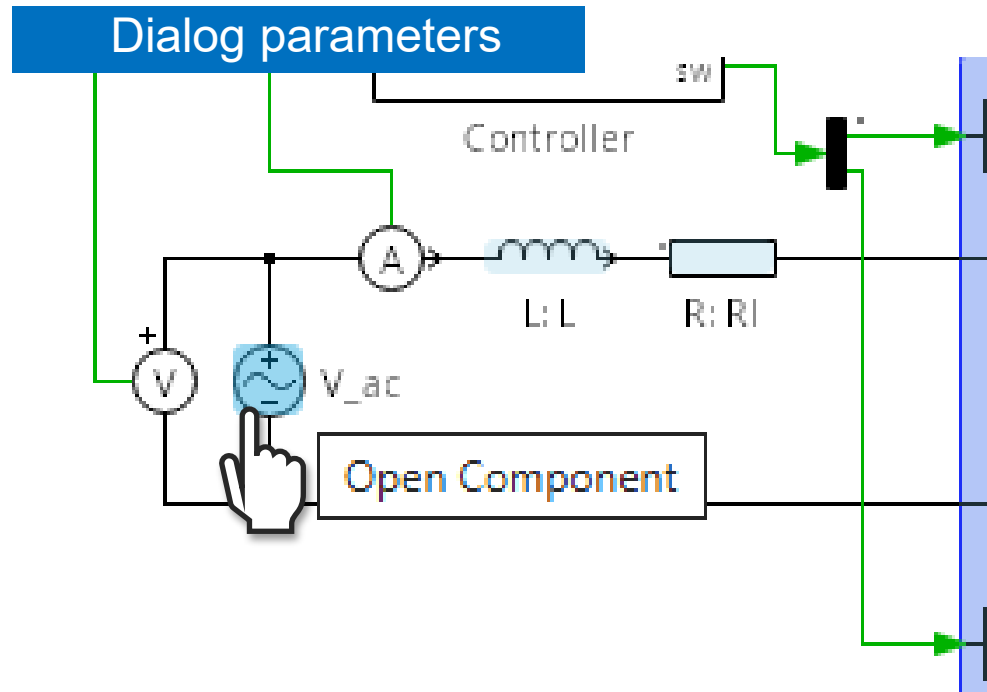
Over your mouse cursor to the device name that you want to change and click the left button of the mouse.

Available device lists are appeared like the above, and you can select a favorite device from these.

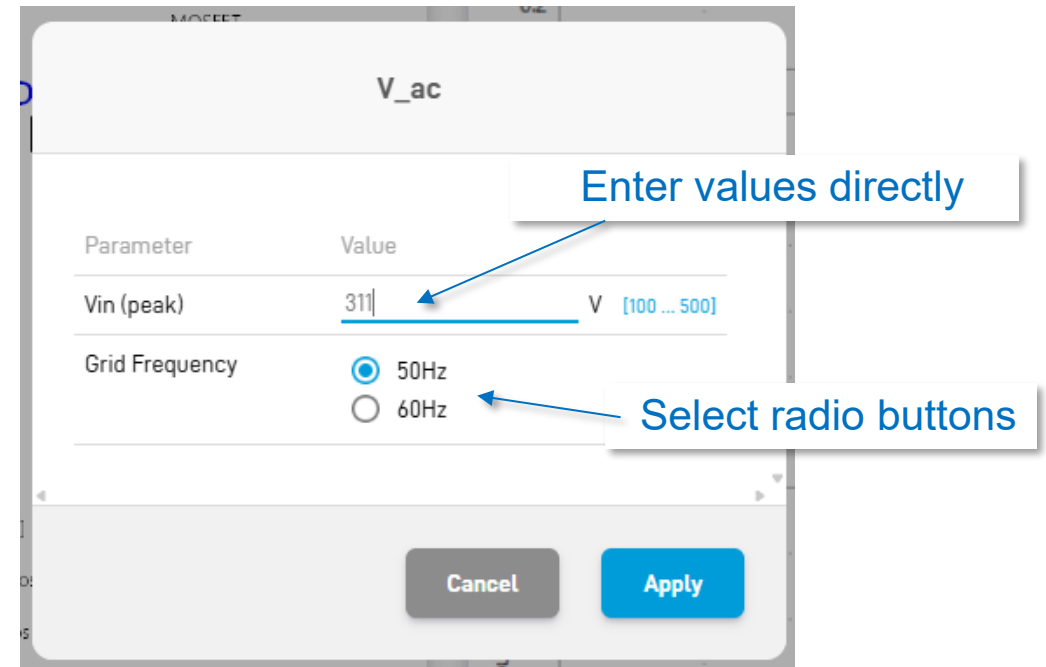
How to change Dialog parameters

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
Circuit Information



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Table parameters

The diagram illustrates the process of changing table parameters. It shows two screenshots of a parameter table. The top screenshot shows a table with 'Test_time' set to 1 sec and 'Switching Frequency' set to 60000 Hz. A hand icon points to the '60000' value. A yellow arrow points down to the second screenshot, which shows the same table but with 'Switching Frequency' set to 20000 Hz. The '20000' value is underlined in blue, and a blue range '[10000 ... 100000]' is visible next to the unit 'Hz'.

Parameter	Value
Test_time	1 sec
Switching Frequency	60000 Hz

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

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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