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

PLECS Reference Circuit
Circuit Information

Simulation Parameters

	Name	Content	unit	Default Value	Variable Range
	Cout	Output Capacitor	F	500u	1u ～ 10m
	ESR	ESR of Cout	Ω	3m	1u ～ 100
	L	Inductive Load	H	300u	1u ～ 10m
	Rl	Choke Resistance	Ω	100m	1m ～ 100
Transformer	Lm	Magnetizing Inductance	H	2m	1u ～ 10m
Transformer	Np	Number of Primary windings	turns	3	1~100
Transformer	Ns	Number of Secondary windings	turns	1	1~100
Transformer	Rtr	Parasitic Resistance	Ω	100m	1m ～ 10
MOS FET	Thcap_mos	Thermal Capacitance	J/K	0.1	1m ～ 100
MOS FET	Rth_mos	Thermal Resistance	K/W	0.5	1m ～ 100
Reset Diode	Thcap_rst	Thermal Capacitance	J/K	0.1	1m ～ 100
Reset Diode	Rth_rst	Thermal Resistance	K/W	0.5	1m ～ 100
Rectifier Diode	Thcap_rec	Thermal Capacitance	J/K	0.1	1m ～ 100
Rectifier Diode	Rth_rec	Thermal Resistance	K/W	0.5	1m ～ 100
FW Diode	Thcap_fw	Thermal Capacitance	J/K	0.1	1m ～ 100
FW Diode	Rth_fw	Thermal Resistance	K/W	0.5	1m ～ 100
	TGND	Thermal GND Temperature	℃	25	-40 ～ 175

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~ 1000
Vout	Output Voltage	V	48	5 ~ 1000
Pout	Output Power	W	500	10~100k
Rg_on	Gate Resistance (Source)	Ω	4.7	0.1 ～ 100
Rg_off	Gate Resistance (Sink)	Ω	4.7	0.1 ～ 100
T_init	Initial Junction Temperature	℃	25	-40 ～ 175

Simulation Circuit

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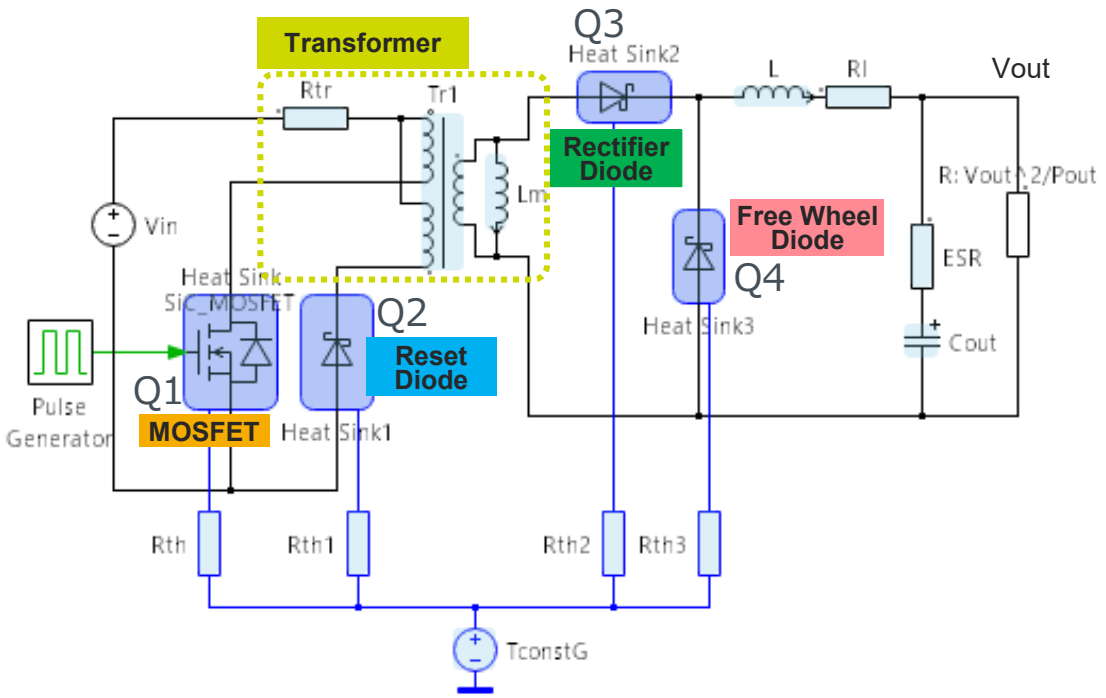

※Transformer has two primary windings, and the both have the same number of turns.

Default Devices

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

Simulation Screen Overview

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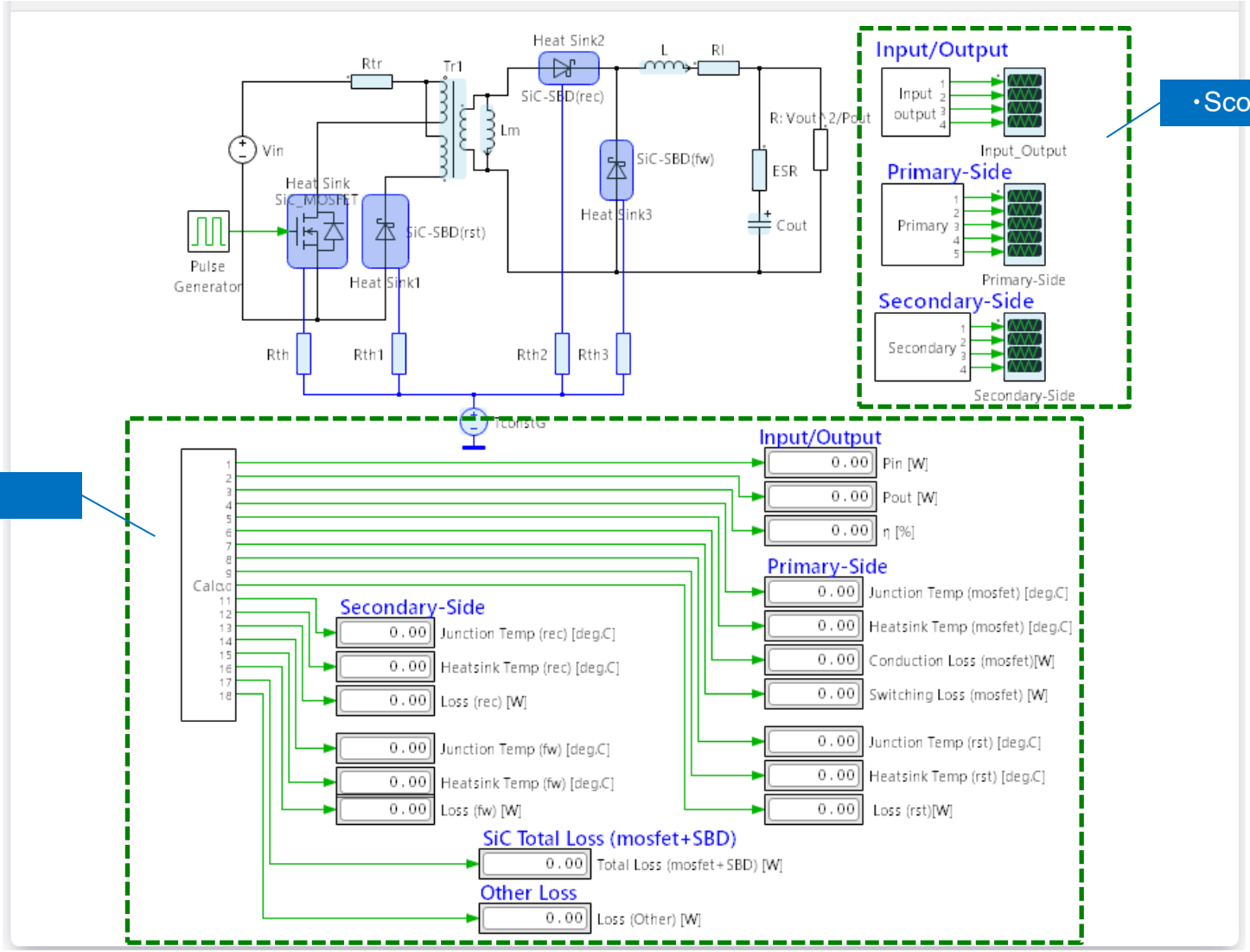
Schematic window



・Scope the waveform

・Results display

Simulation Results

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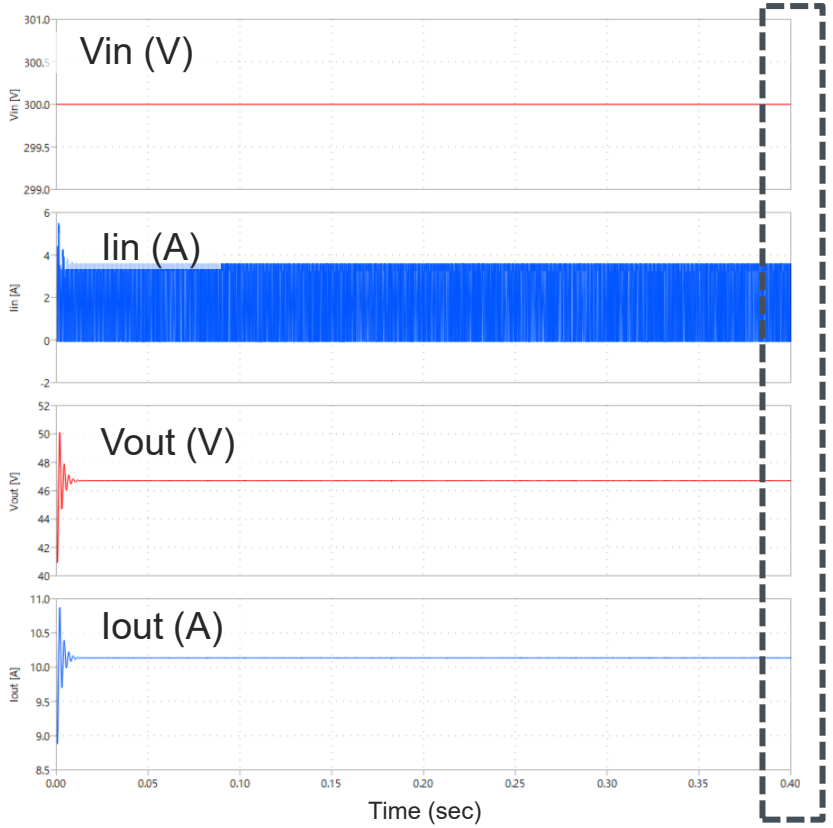
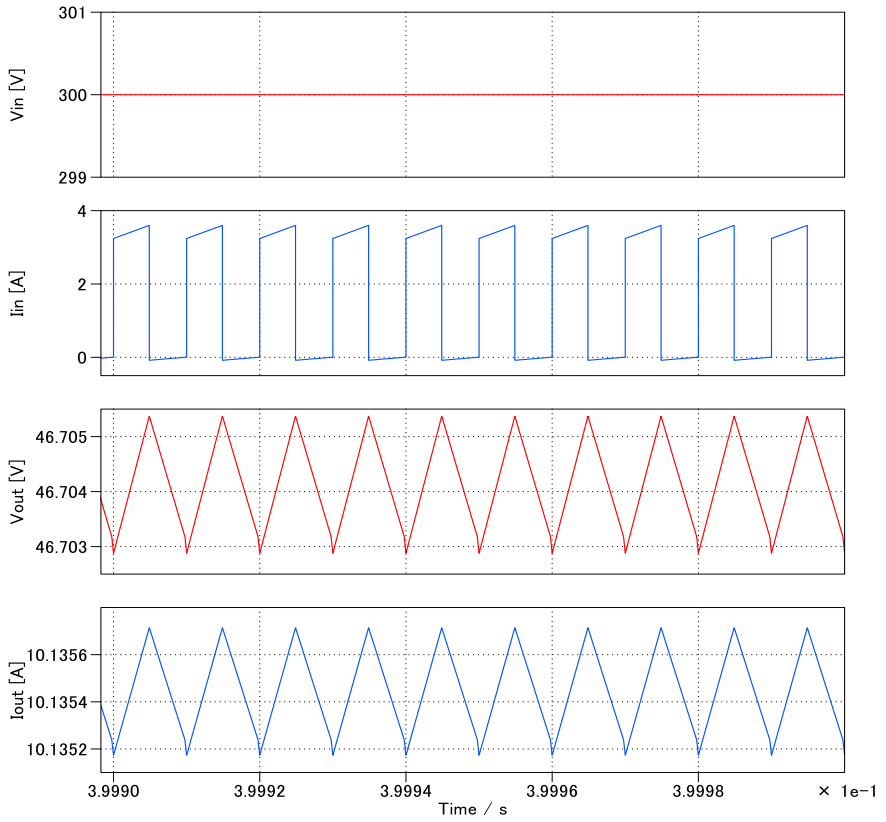
Input and Output





Contents	Results
Input Power : Pin	499.8(W)
Output Power: Pout	473.4 (W)
Efficiency: η	94.72 (%)

Simulation Results

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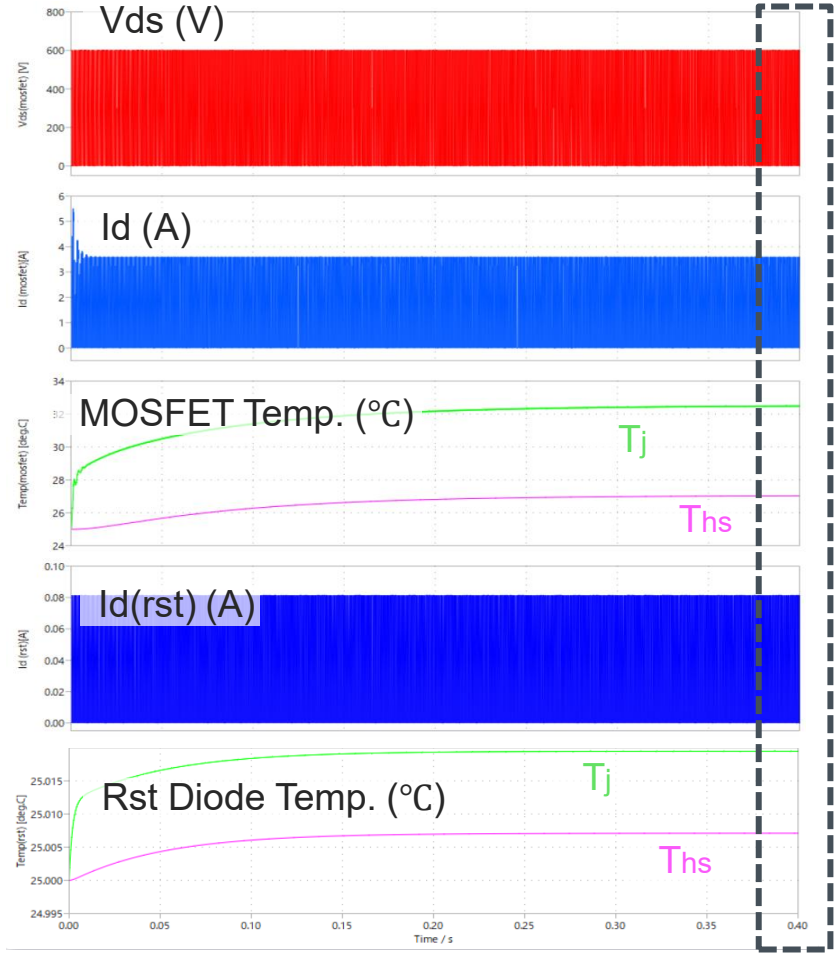
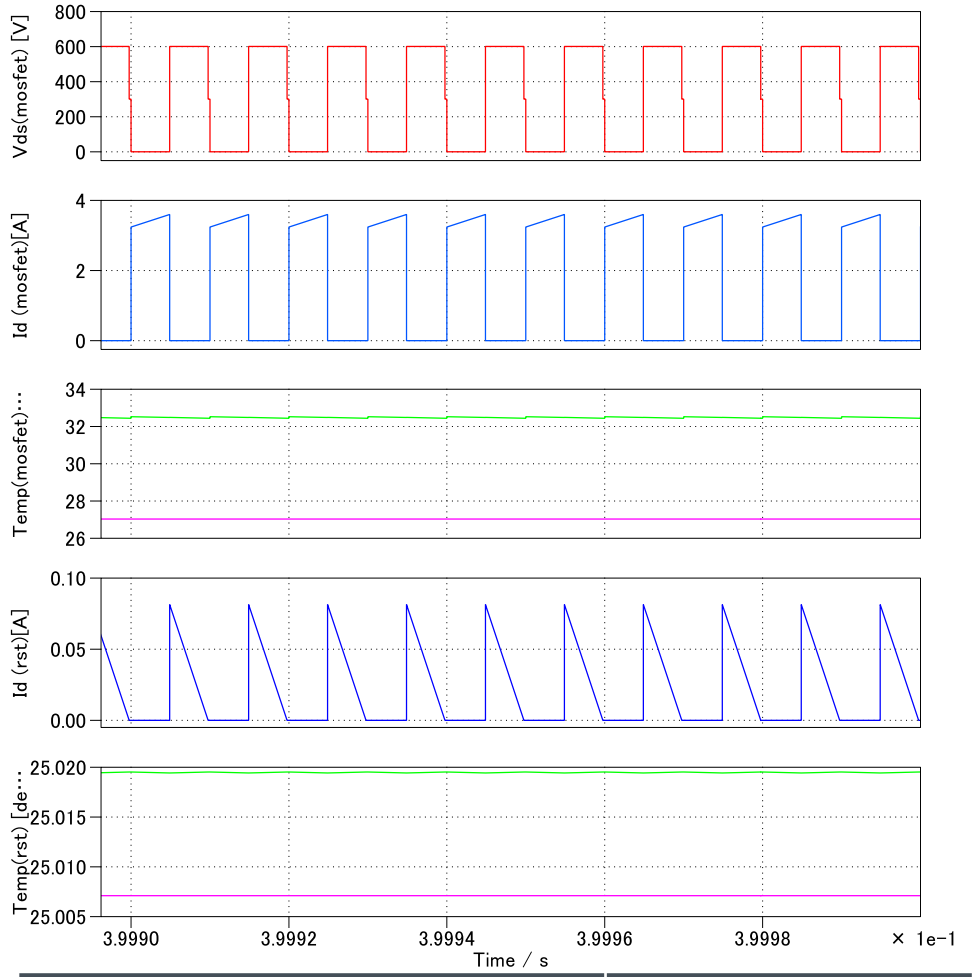
Primary Side





Contents	Results
Junction Temp: Tj (mosfet)	32.48 (℃)
Heatsink Temp: Ths (mosfet)	27.03 (℃)
Conduction Loss: Pcond (mosfet)	0.42 (W)
Switching Loss: Psw (mosfet)	3.70(W)

Contents	Results
Junction Temp : Tj (rst)	25.02(℃)
Heatsink Temp: Ths (rst)	25.01(℃)
RST Diode Loss: Pcond(rst)	0.01(W)

Simulation Results

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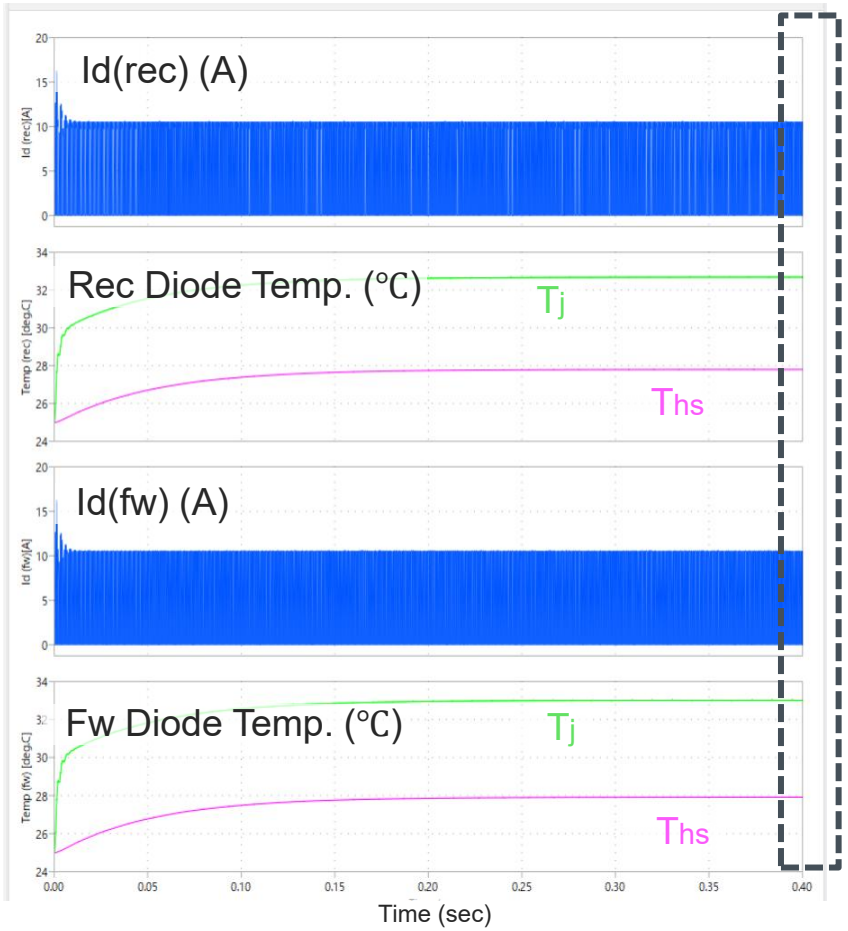
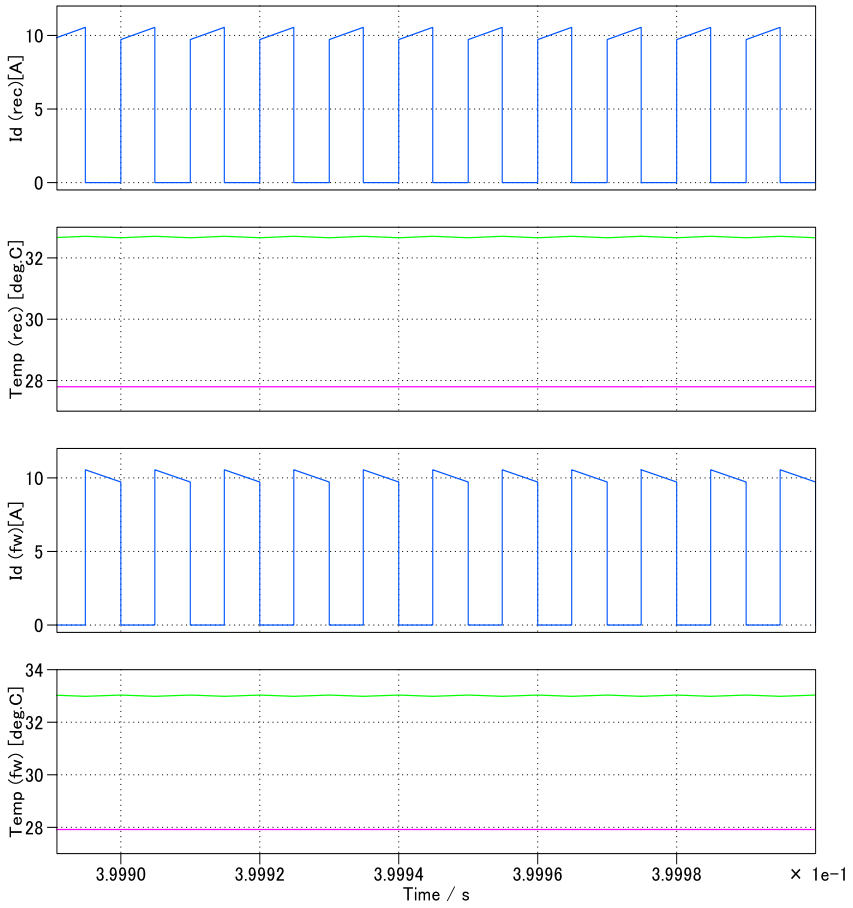
Secondary Side





Contents	Results
Junction Temp : T(rec)	32.68 (℃)
Heatsink Temp : Ths (rec)	27.80 (℃)
REC Diode Loss: Pcond(rec)	5.60 (W)

Contents	Results
Junction Temp : T(fw)	33.01(℃)
Heatsink Temp : Ths (fw)	27.92(℃)
FW Diode Loss: Pcond(fw)	5.84 (W)
Total Loss: Ptotal (mosfet+SBD)	15.56 (W)

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To run this PLECS Reference Circuit, you must have the "PLECS" simulation software installed on your computer.

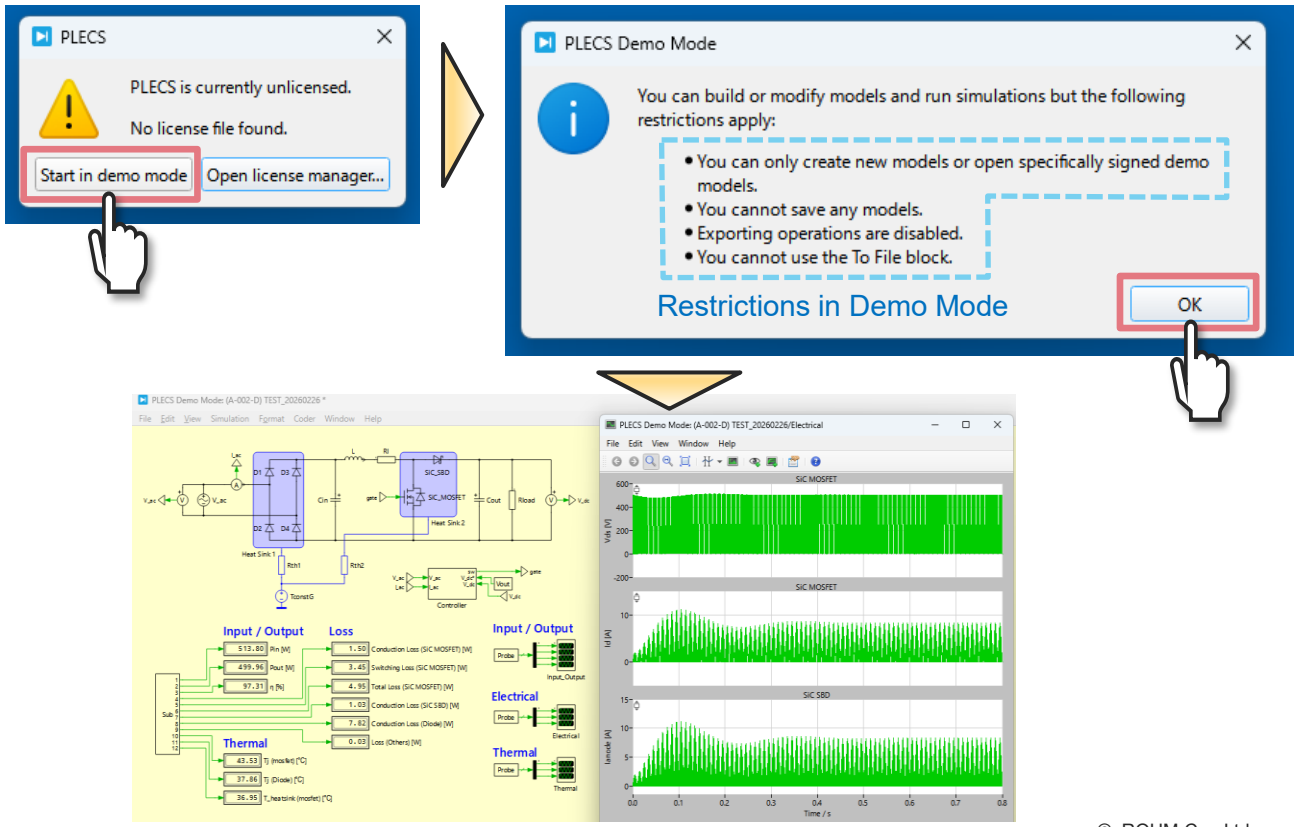
1. Obtaining the Software

If you do not have PLECS installed, please download the installer from the official website and complete the setup process.

https://www.plexim.com/download

2. Licensing (Using Demo Mode)

This reference circuit can be executed and viewed in "Demo Mode" even if you do not possess a paid license.



How to change the devices

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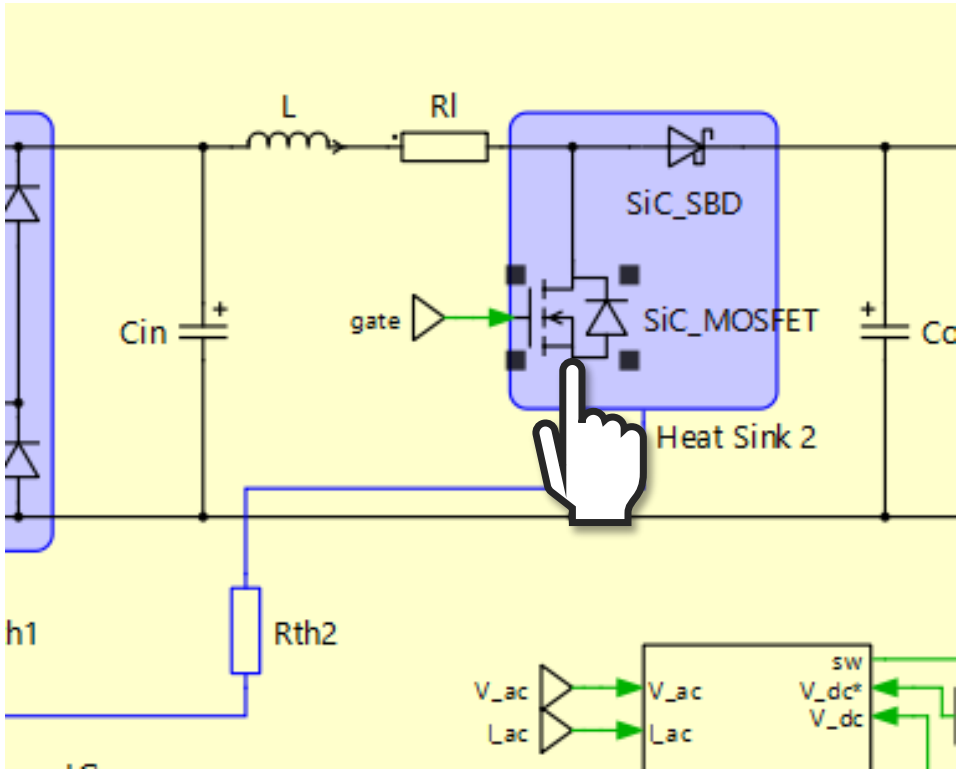
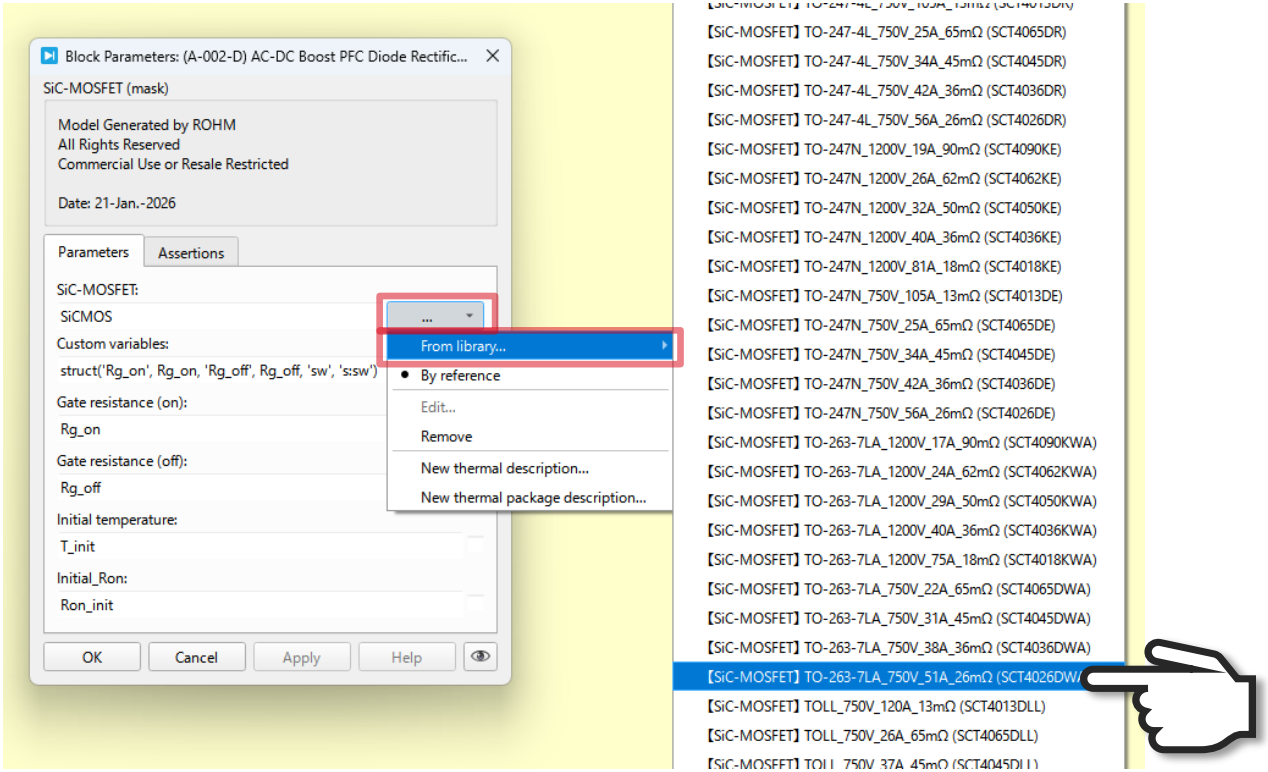
Schematic window





Hover your mouse cursor over the device symbol that you want to change and double-click the left button of the mouse.

Click "..." > "From library..." to view the list of available devices and you can select a favorite device from these.

If the model you need is not in the list, please refer to the application note "How to Use PLECS Models".

How to change the simulation parameters

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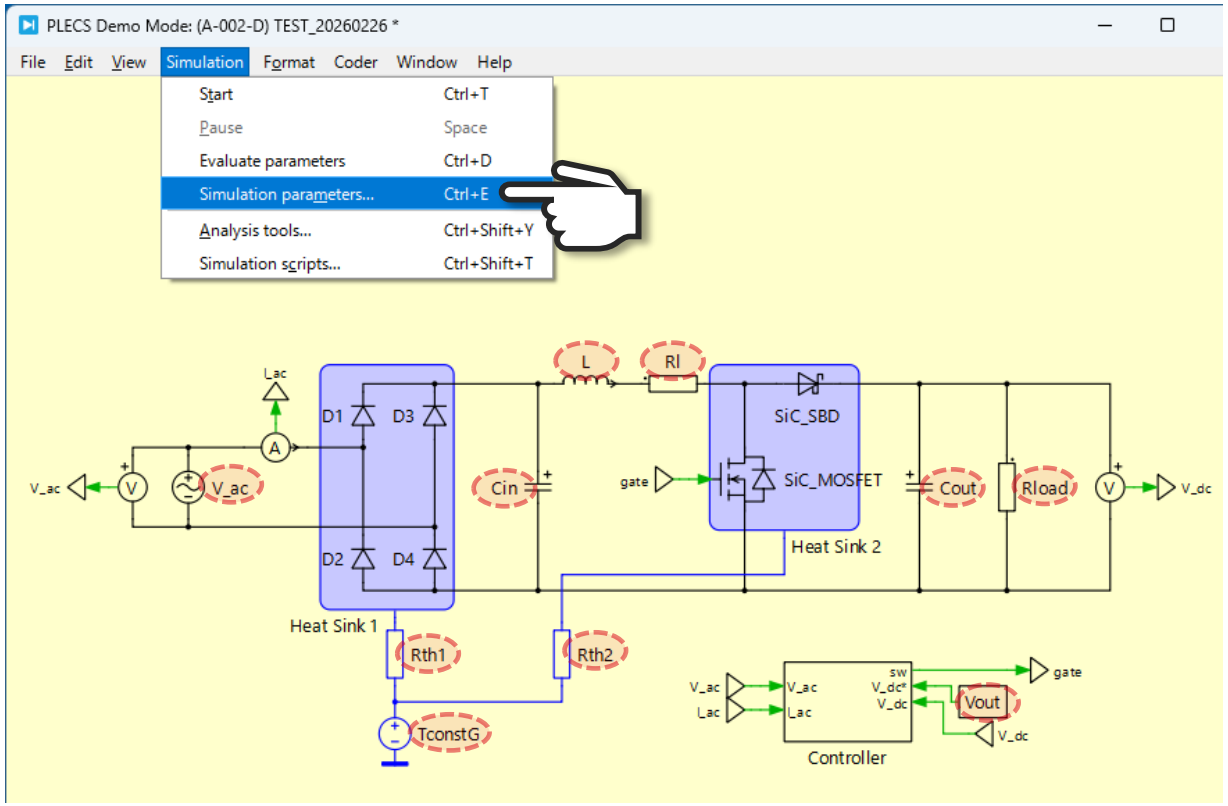
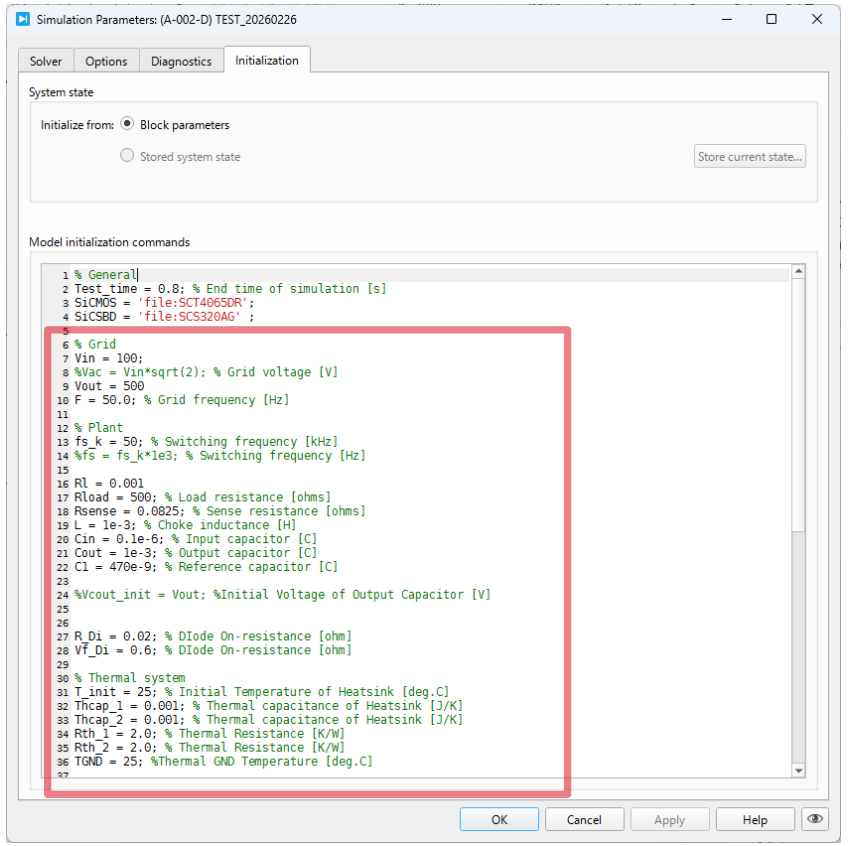
Schematic window





All simulation parameters are parameterized. To modify them, go to the menu, select “Simulation parameters...” , and edit the values within "Model initialization commands."

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