(C-023-D) DC-DC LLC Half-Bridge Buck Converter (Discrete)

PLECS Reference Circuit
Circuit Information

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68UG135E Rev.001

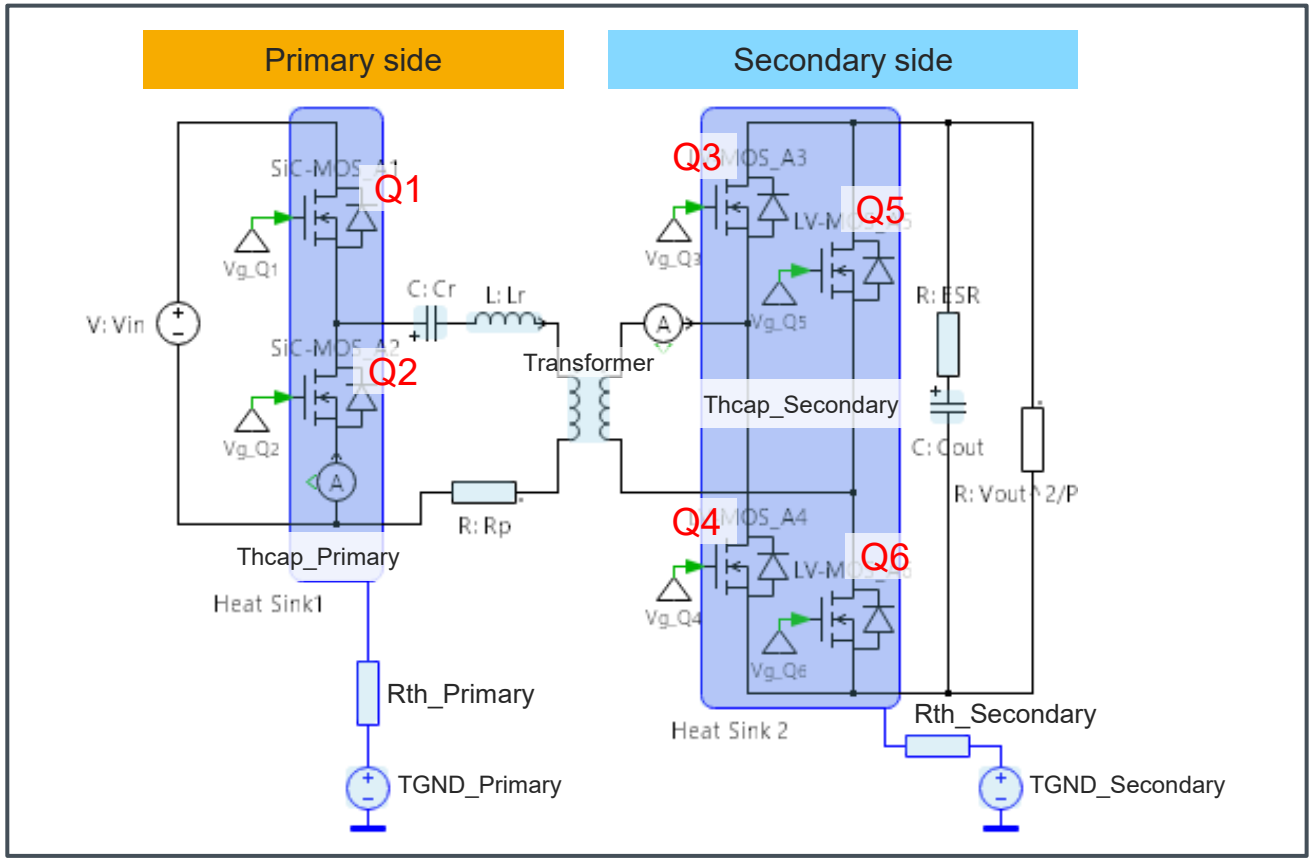
Simulation Parameters

	Name	Content	unit	Default Value	Variable Range
	Transformer	Np: Primary-turns Ns: Secondary-turns Lm: Magnetizing Inductance	turns turns H	9 1 60u	1 ～ 1,000 1 ～ 1,000 1n～1
	Rp	Transformer Resistance	Ω	2m	1m ～ 1
	Lr	Resonant Inductance	H	12u	1n ～ 1
	Cr	Resonant Capacitance	F	100n	1n ～ 1
	Cout	Output Capacitance Initial Voltage	F V	4.7m 50	1n ～ 1 0 ～ 80
	ESR	ESR of Cout	Ω	15m	1m ～ 1
Primary	Thcap_Primary	Thermal Capacitance	J/K	0.1	1m ～ 100
Primary	Rth_Primary	Thermal Resistance	K/W	0.2	1m ～ 100
Primary	TGND_Primary	Ambient Temperature	℃	25	-40 ～ 175
Secondary	Thcap_Secondary	Thermal Capacitance	J/K	0.1	1m ～ 100
Secondary	Rth_Secondary	Thermal Resistance	K/W	0.2	1m ～ 100
Secondary	TGND_Secondary	Ambient Temperature	℃	25	-40 ～ 175

	Name	Content	unit	Default Value	Variable Range
	Test_time	Test time in simulation	s	0.3	100u ～ 1
	Vin_dc	Input Voltage	V	800	400 ～ 1,200
	Vout_dc	Output Voltage	V	50	10 ～ 80
	Pout	Output Power	W	5,000	100～10,000
	fs_ref	Target Carrier Frequency	Hz	100k	10k～500k
Primary	Rg_on 1*	Gate Resistance (Source)	Ω	2	0.1 ～ 100
Primary	Rg_off 1*	Gate Resistance (Sink)	Ω	1	0.1 ～ 100
Primary	DT1	Dead Time	s	200n	0 ～1m
Secondary	Rg_on 2*	Gate Resistance (Source)	Ω	10	0.1 ～ 100
Secondary	Rg_off 2*	Gate Resistance (Sink)	Ω	10	0.1 ～ 100
Secondary	DT2	Dead Time	s	200n	0 ～1m
	T_init**	Initial Junction Temp.	℃	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
Q1,2	SiC MOSFET	SCT4050KR	1200V/ 32A/ 50mΩ/ TO-247-4L
Q3～6	Si MOSFET	RS7N200BH	80V/ 200A/ 1.7mΩ/ DFN5060-8S

Simulation Screen Overview

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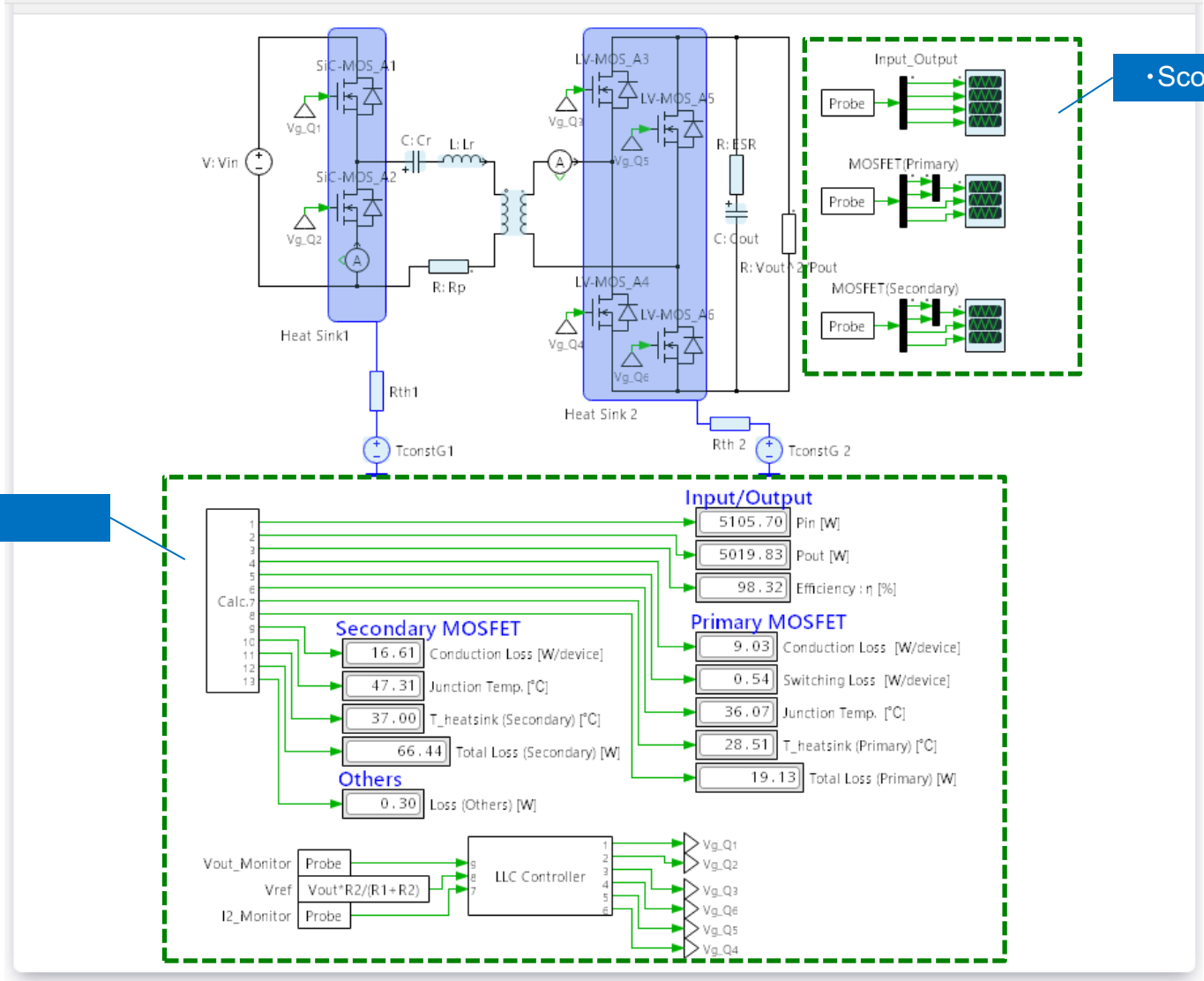
Schematic window



- Scope the waveform
- Results display

Simulation Results 1

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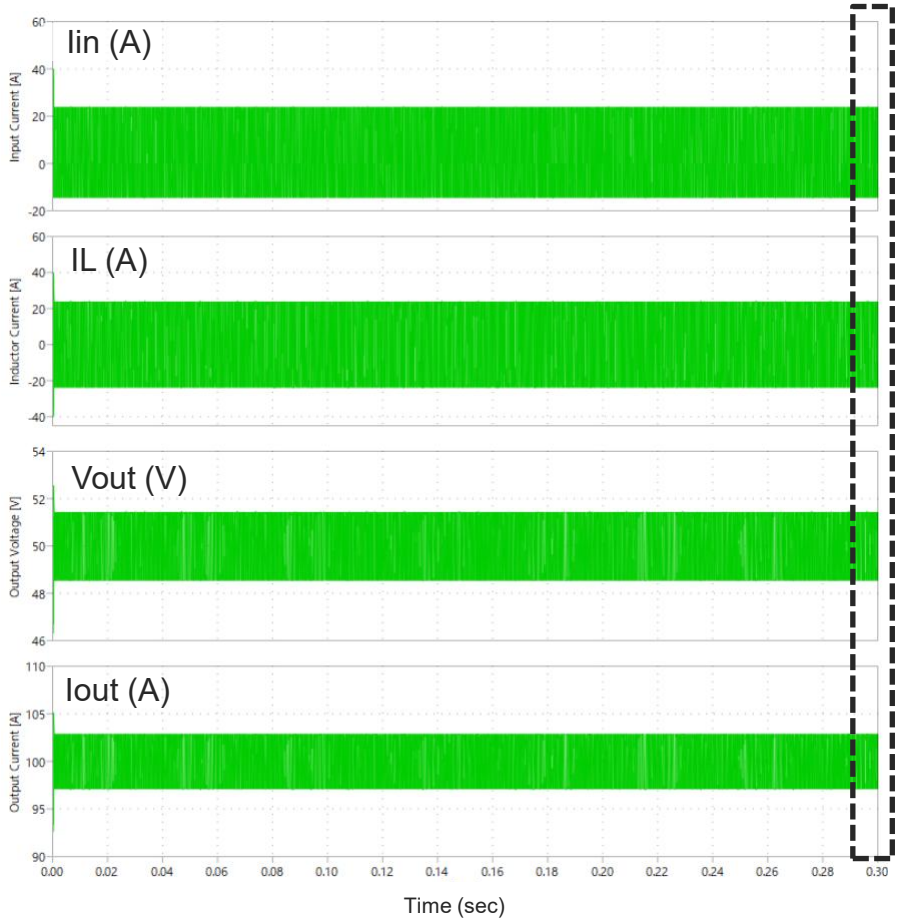
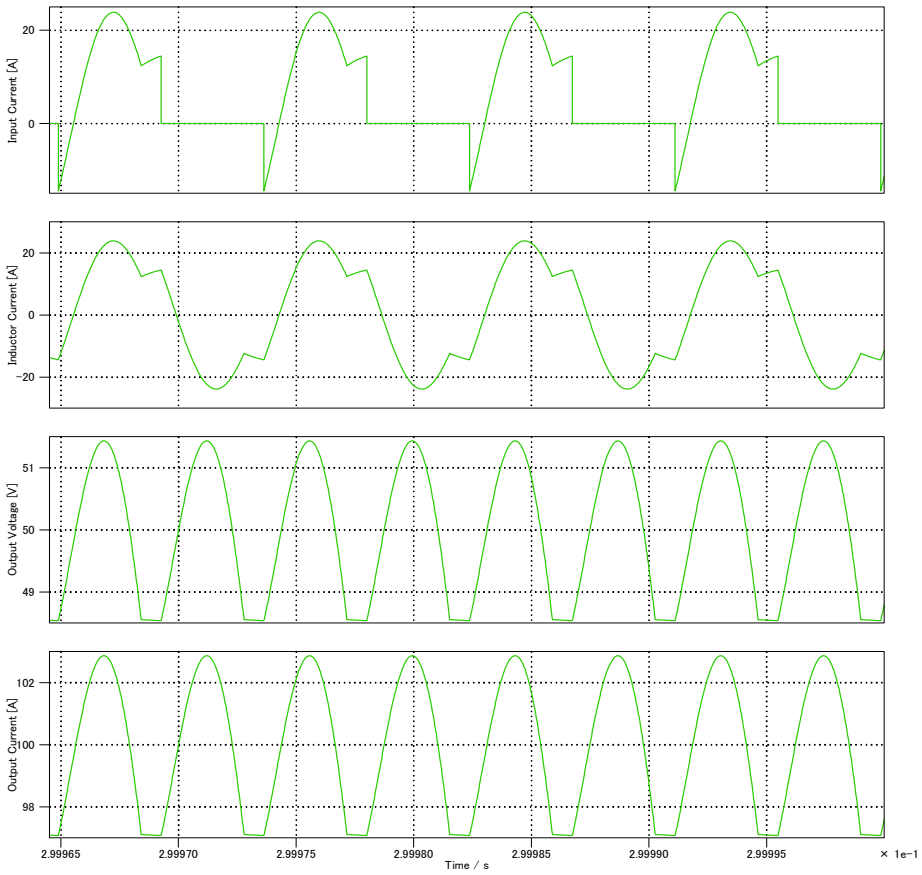
Input and Output





Contents	Results
Input Power : Pin	5.110 (kW)
Output Power: Pout	5.006 (kW)
Efficiency: η	97.98 (%)

Simulation Results 2

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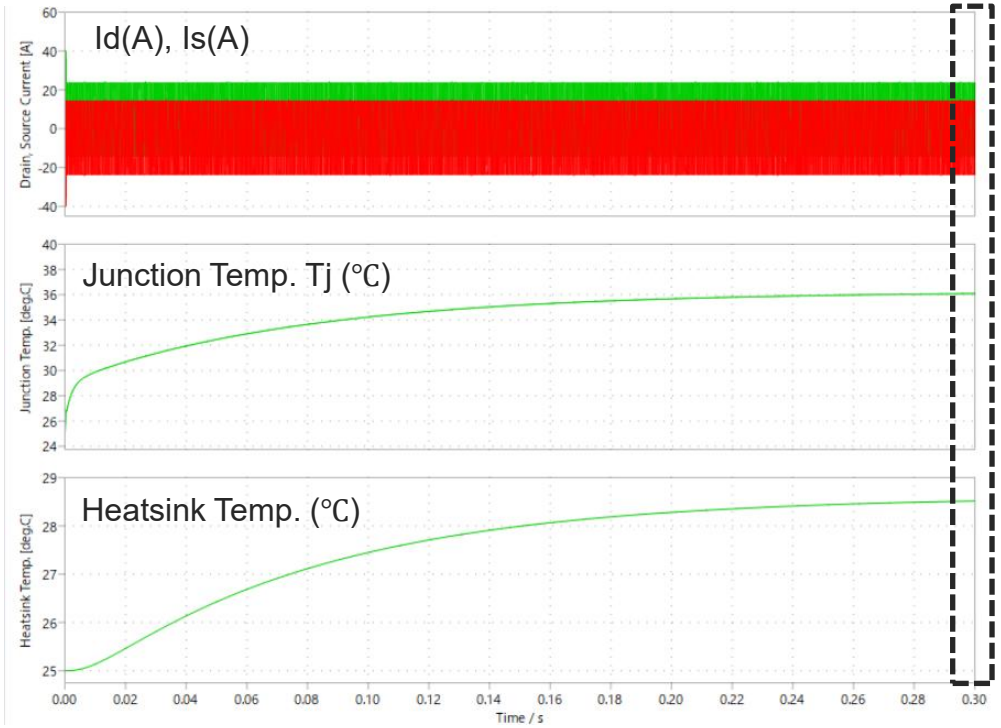
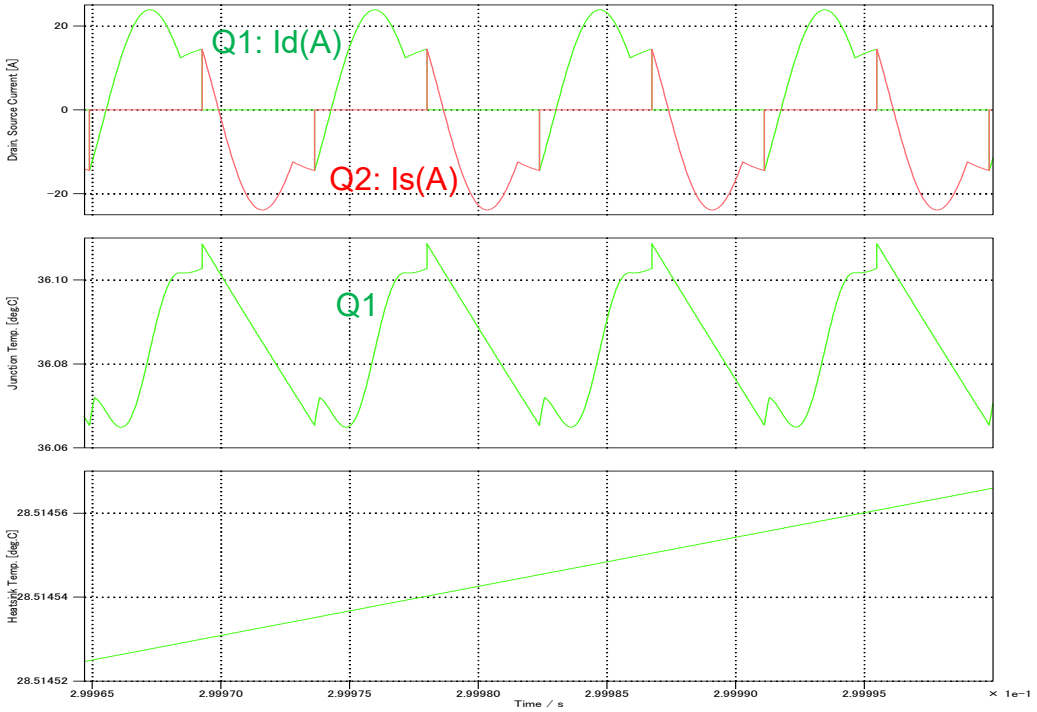
Primary side





Contents	Results
Conduction Loss: Pcond (primary)	8.00 (W/device)
Switching Loss: Psw (primary)	0.68 (W/device)
Junction Temp. : Tj (primary)	36.17 (℃)
Heatsink Temp.: T_hs (primary)	28.54 (℃)
Total Loss: Ptot (primary)	17.35 (W)

Simulation Results 3

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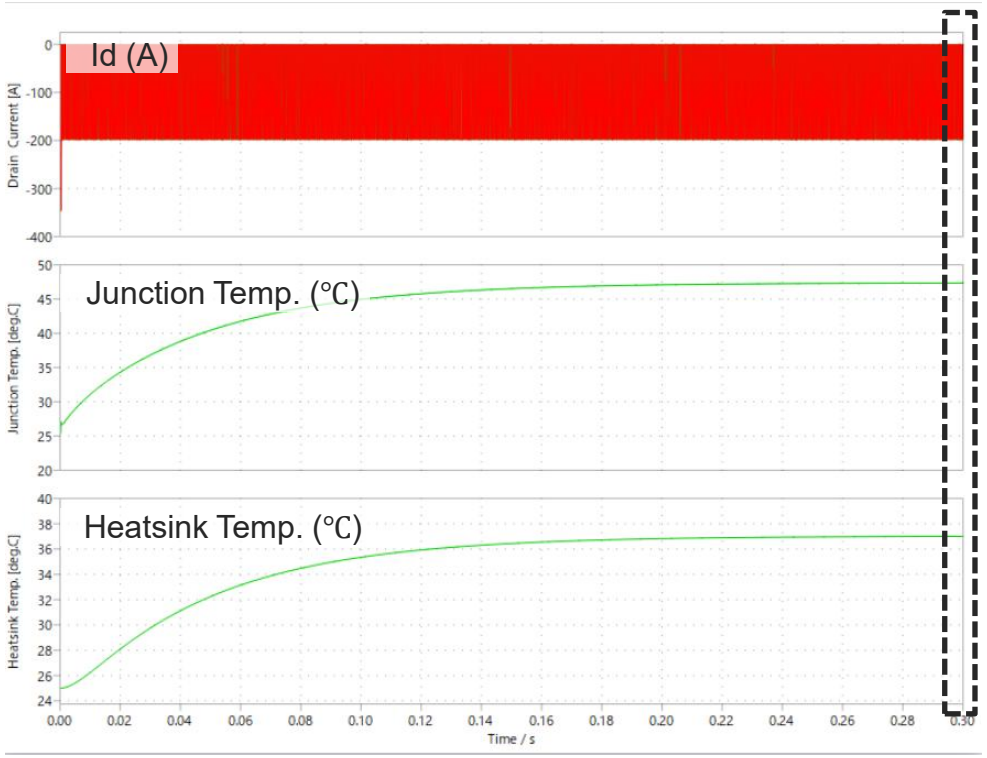
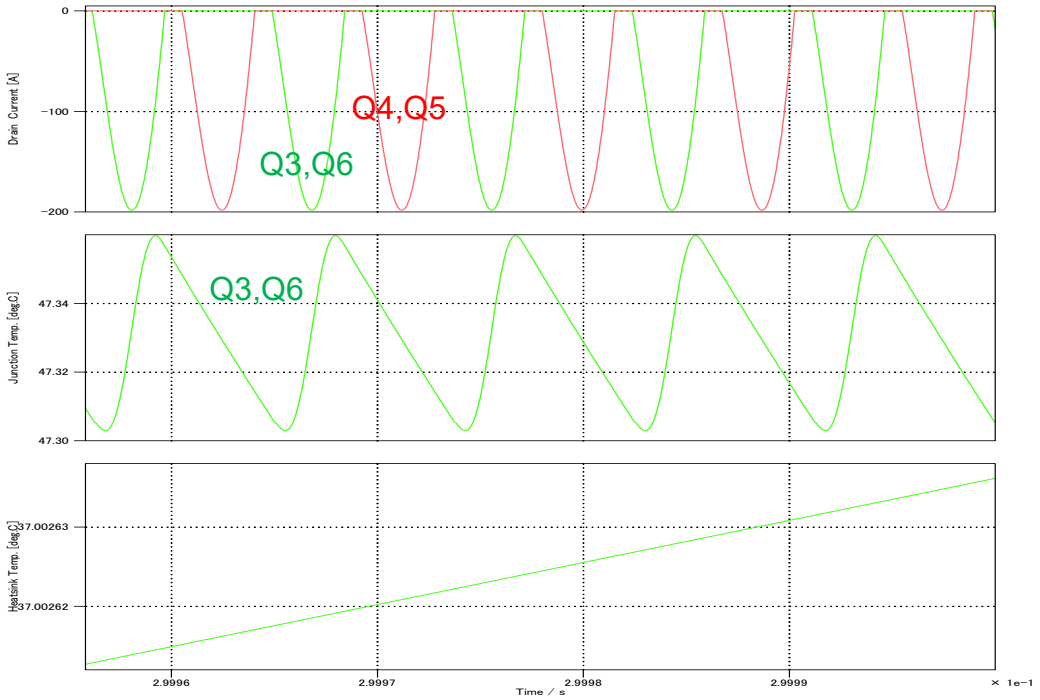
Secondary side





Contents	Results
Conduction Loss: Pcond (secondary)	13.37 (W/device)
Junction Temp. : Tj (secondary)	47.55 (℃)
Heatsink Temp.: T_hs (secondary)	37.11 (℃)
Total Loss: Ptot (secondary)	53.48 (W)

Preparation for Use

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

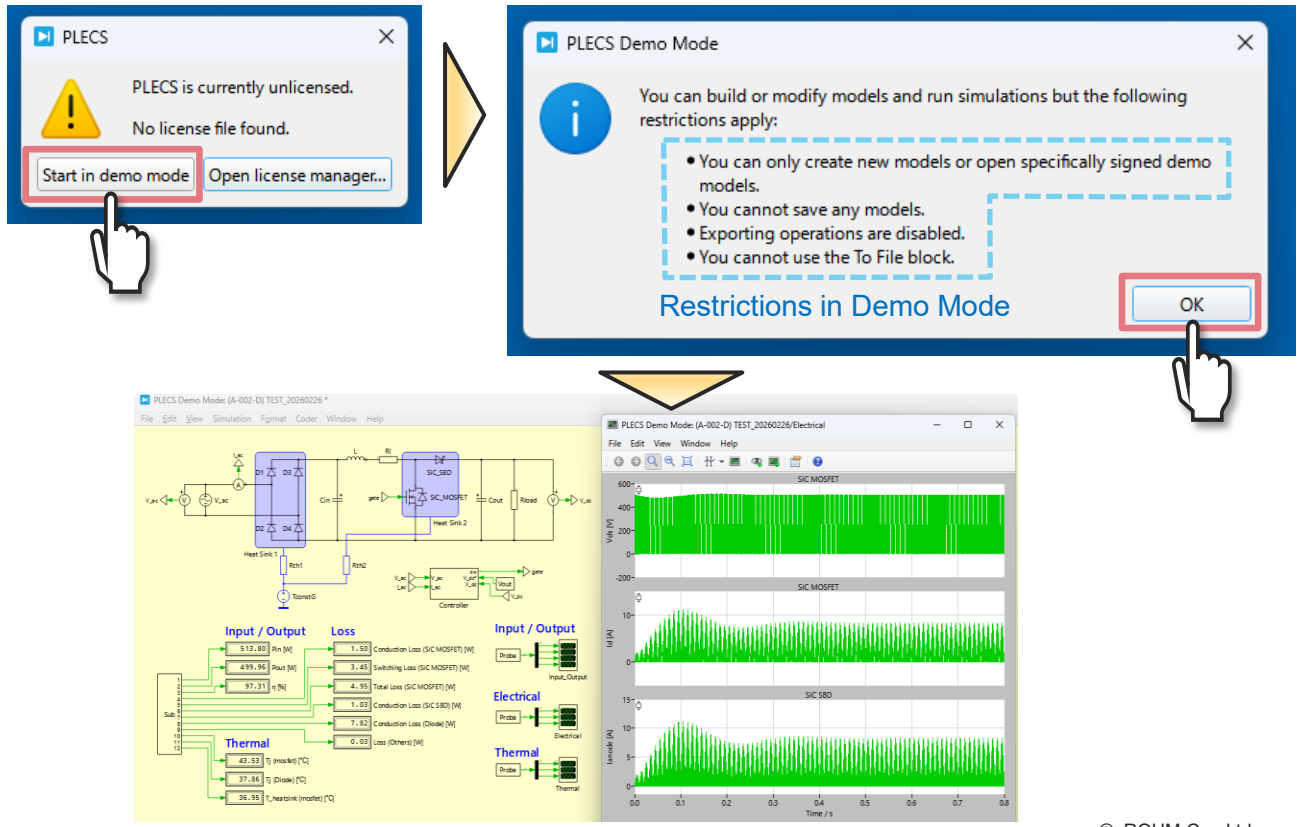
1. Obtaining the Software

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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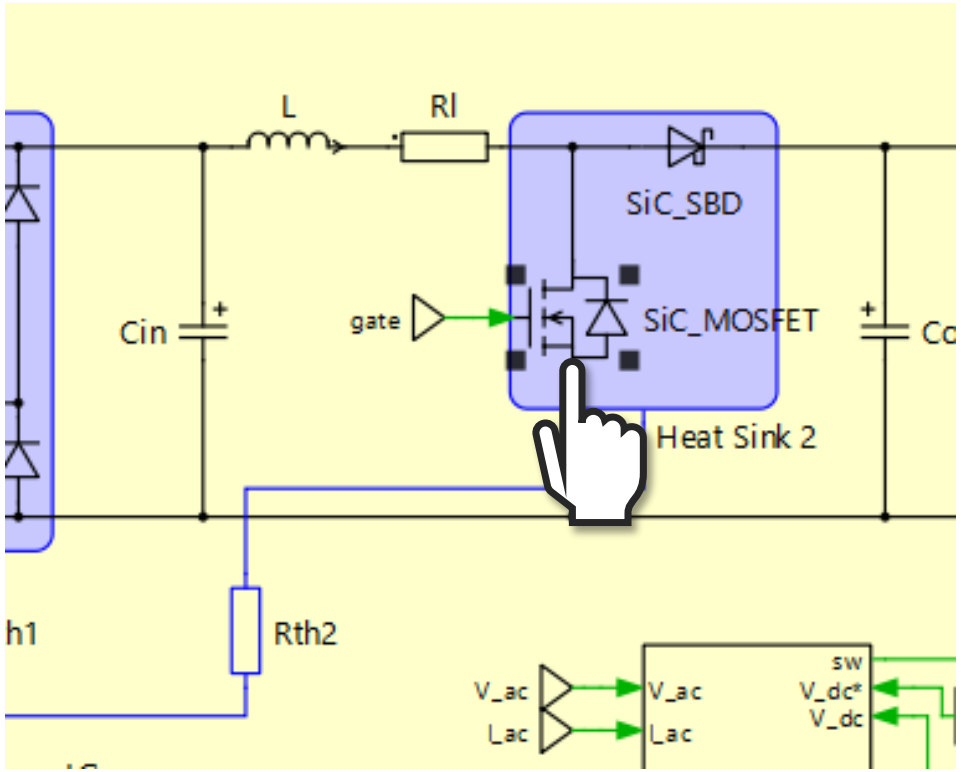
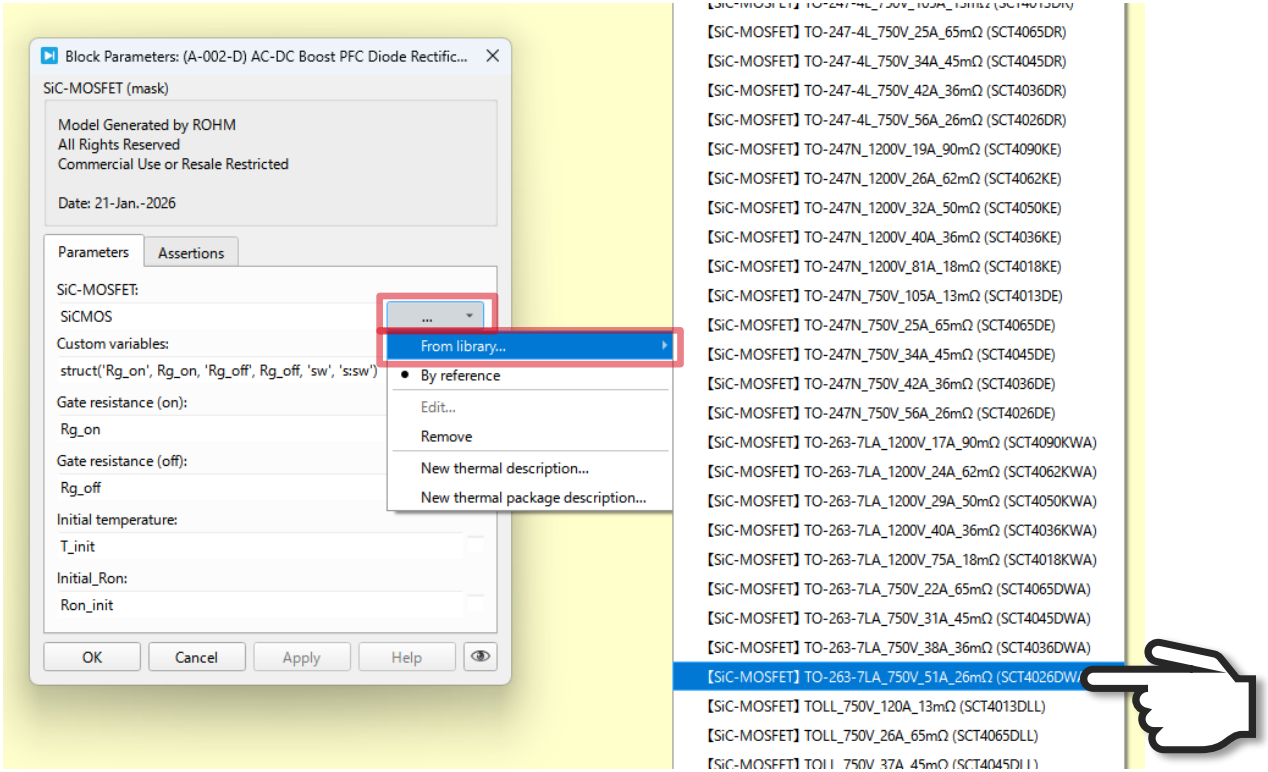
Schematic window





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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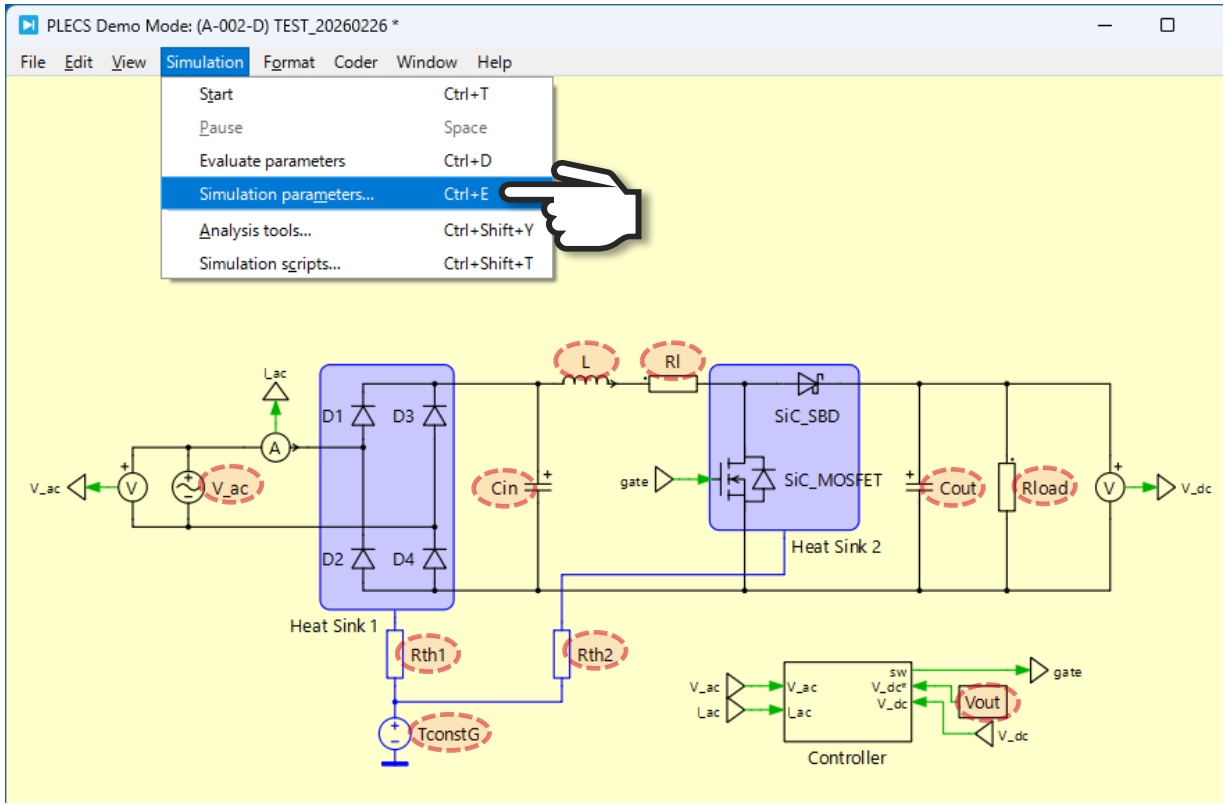
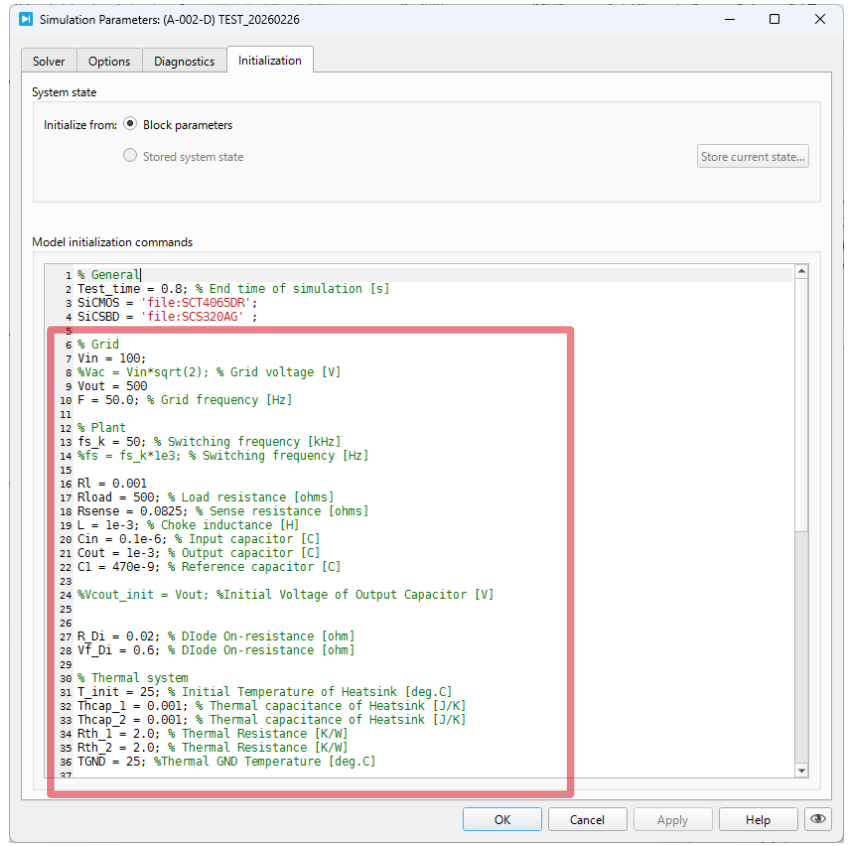
Schematic window





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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