

(C-014-D) DC-DC LLC Full-Bridge Converter (Discrete)

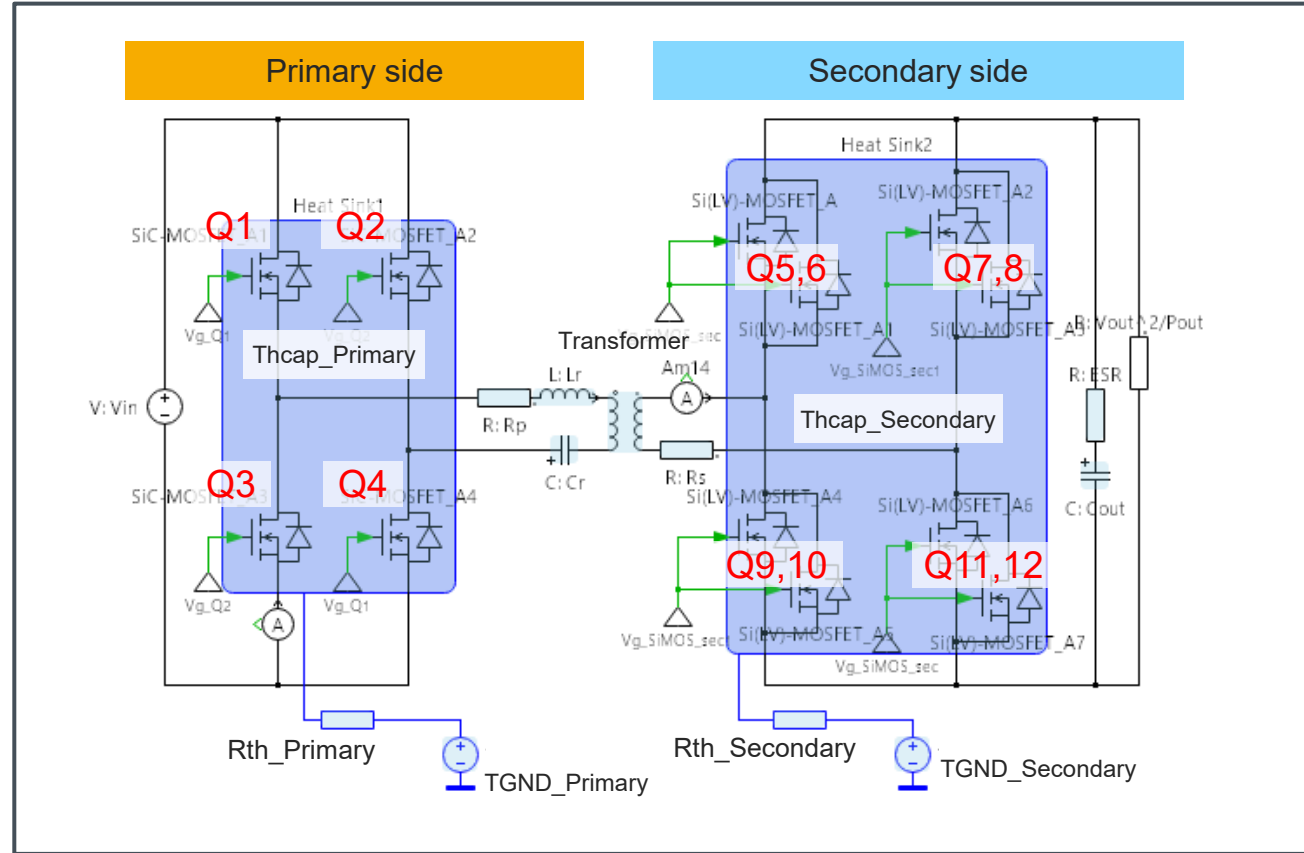
Simulation Parameters

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 ~ 100
	Rth_Primary	Thermal Resistance	K/W	0.1 ~ 100
	TGND_Primary	Ambient Temperature	°C	-40 ~ 175
Secondary	Thcap_Secondary	Thermal Capacitance	J/K	0.1 ~ 100
	Rth_Secondary	Thermal Resistance	K/W	0.1 ~ 100
	TGND_Secondary	Ambient Temperature	°C	-40 ~ 175

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 ~ 100
	Rg_off 1*	Gate Resistance (Sink)	Ω	2.0 ~ 100
	DT1	Dead Time	s	100n ~ 1m
Secondary	Rg_on 2*	Gate Resistance (Source)	Ω	10 ~ 100
	Rg_off 2*	Gate Resistance (Sink)	Ω	10 ~ 100
	DT2	Dead Time	s	100n ~ 1m
T_init**	Initial Junction Temp.	°C	25	-40 ~ 175

*Common for all MOSFETs in the same side. **Common for all devices

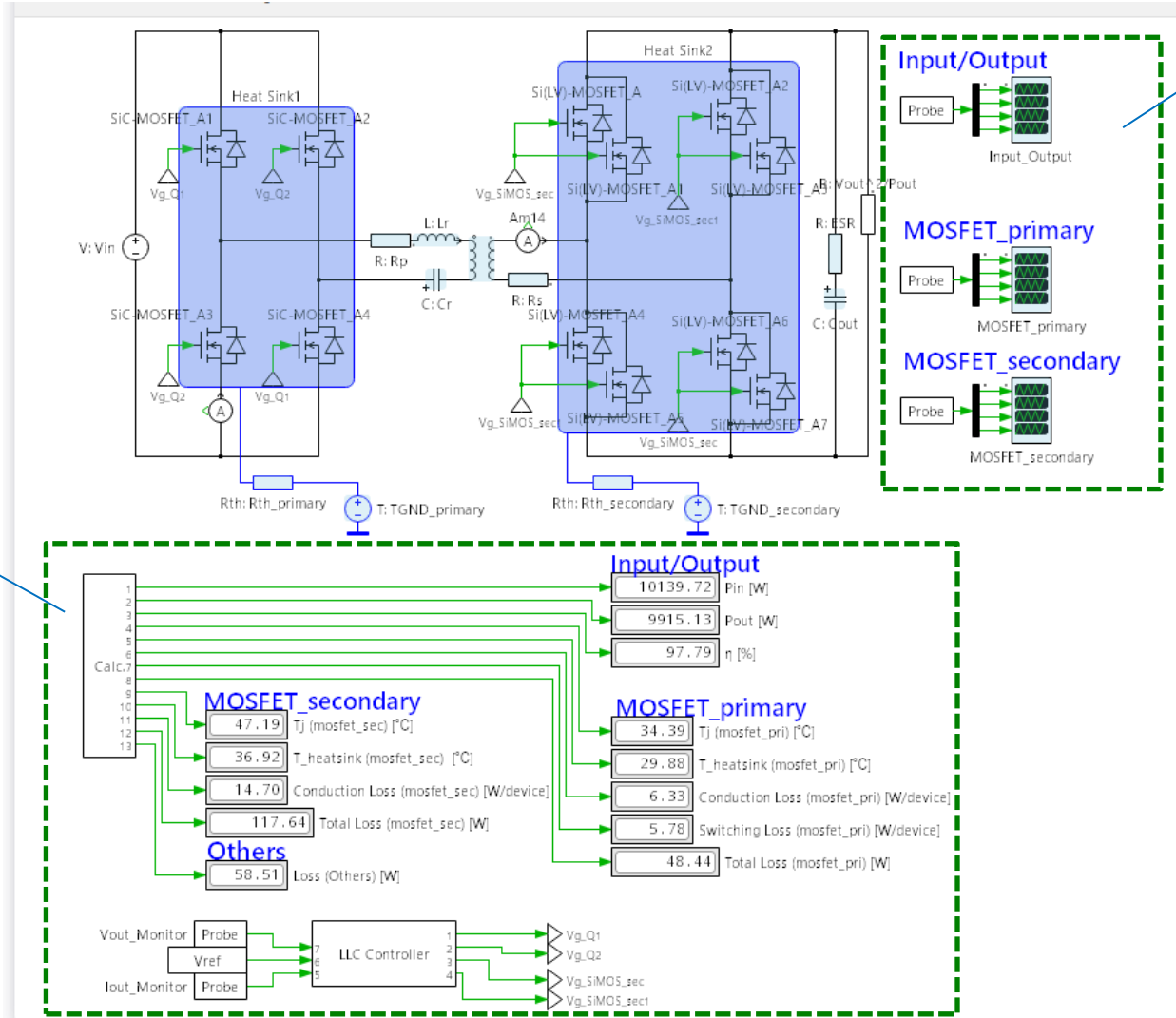
Simulation Circuit



Default Devices

Name	Device Type	Part No.	Specification
Q1~4	SiC MOSFET	SCT4018KR	1200V/ 81A/ 18mΩ/ TO-247-4L
Q5~12	Si MOSFET	RS7N200BH	80V/ 200A/ 1.7mΩ/ DFN5060-8S

Schematic window

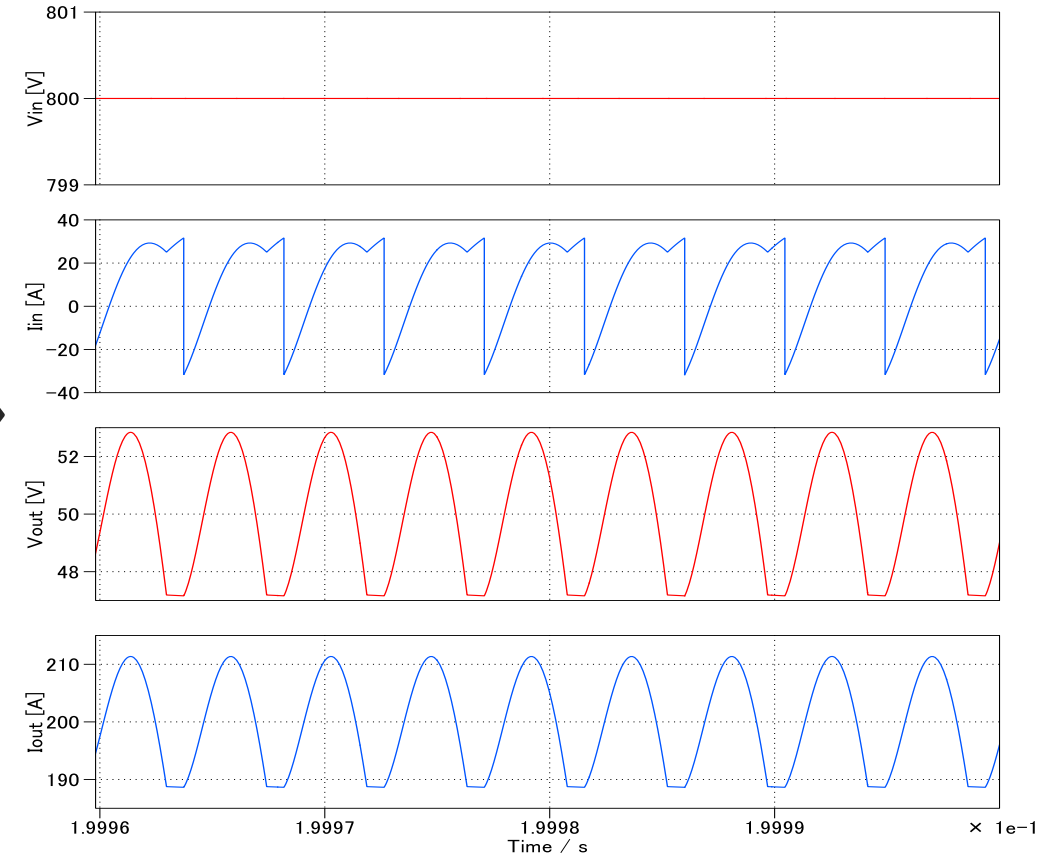
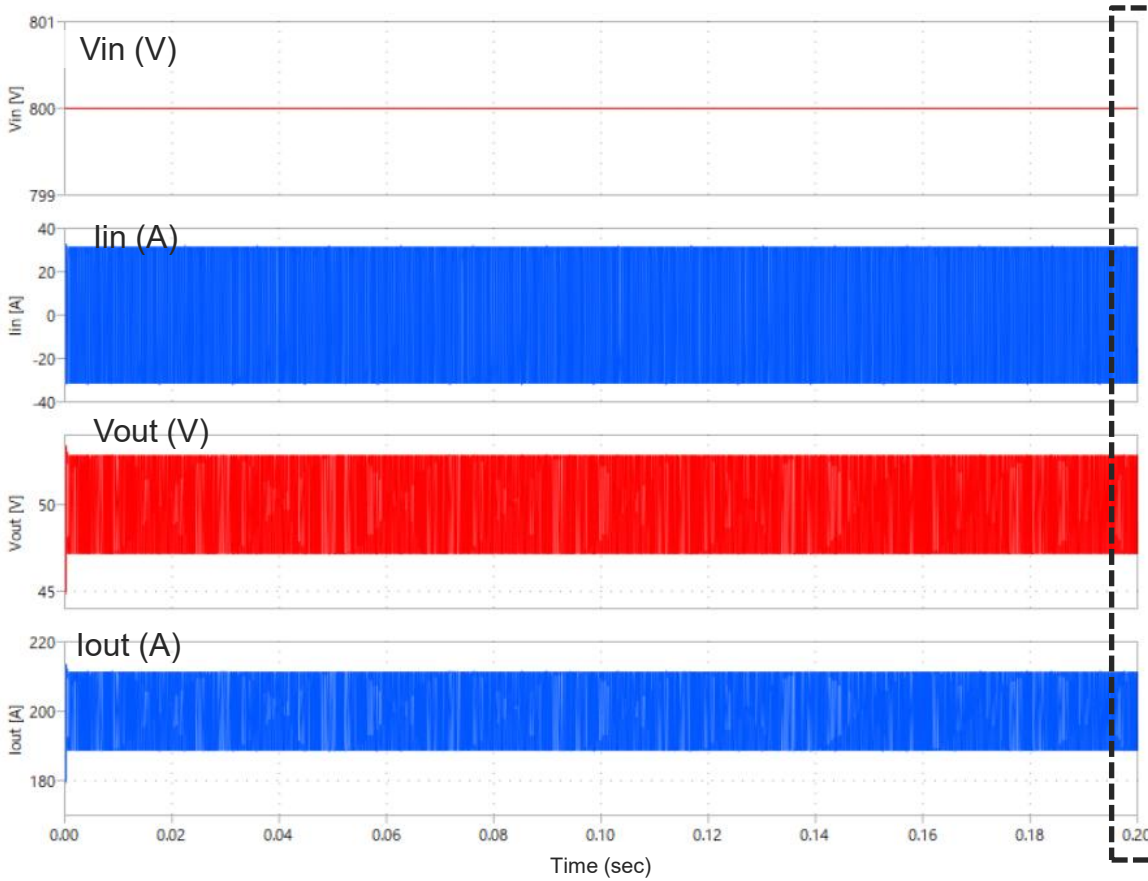


•Results display

•Scope the waveform

Simulation Results 1

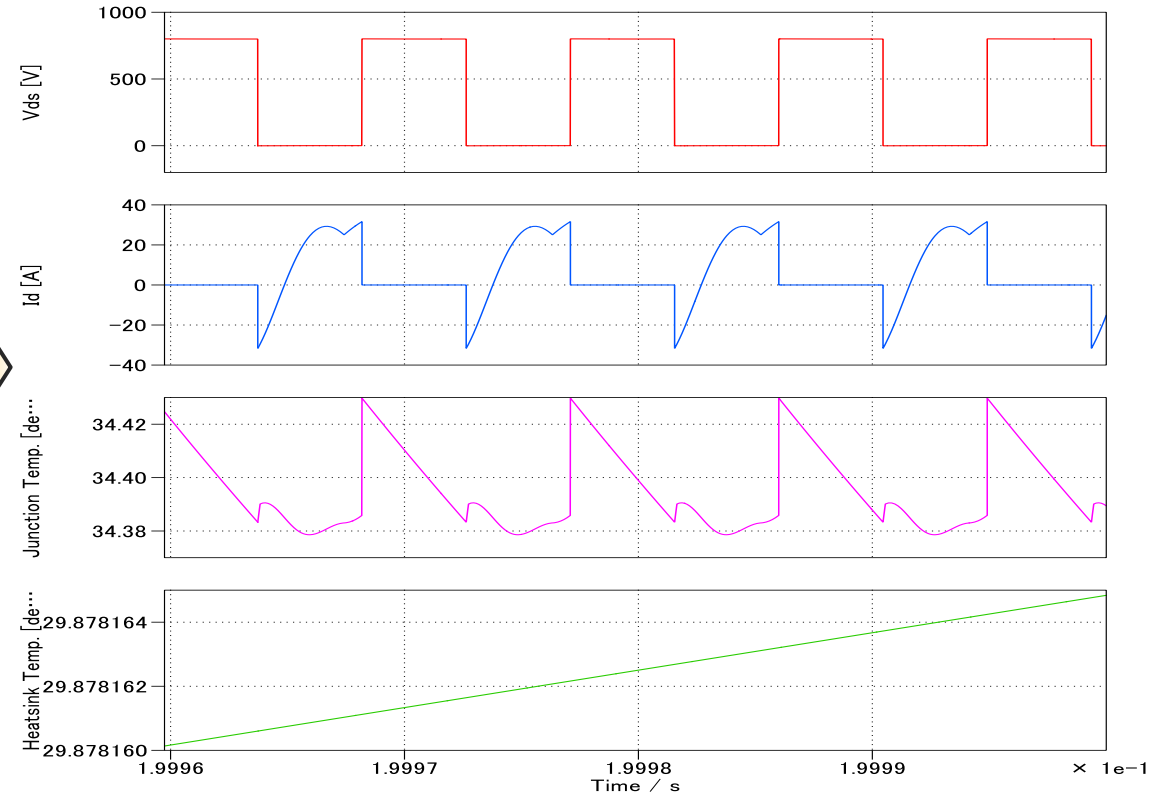
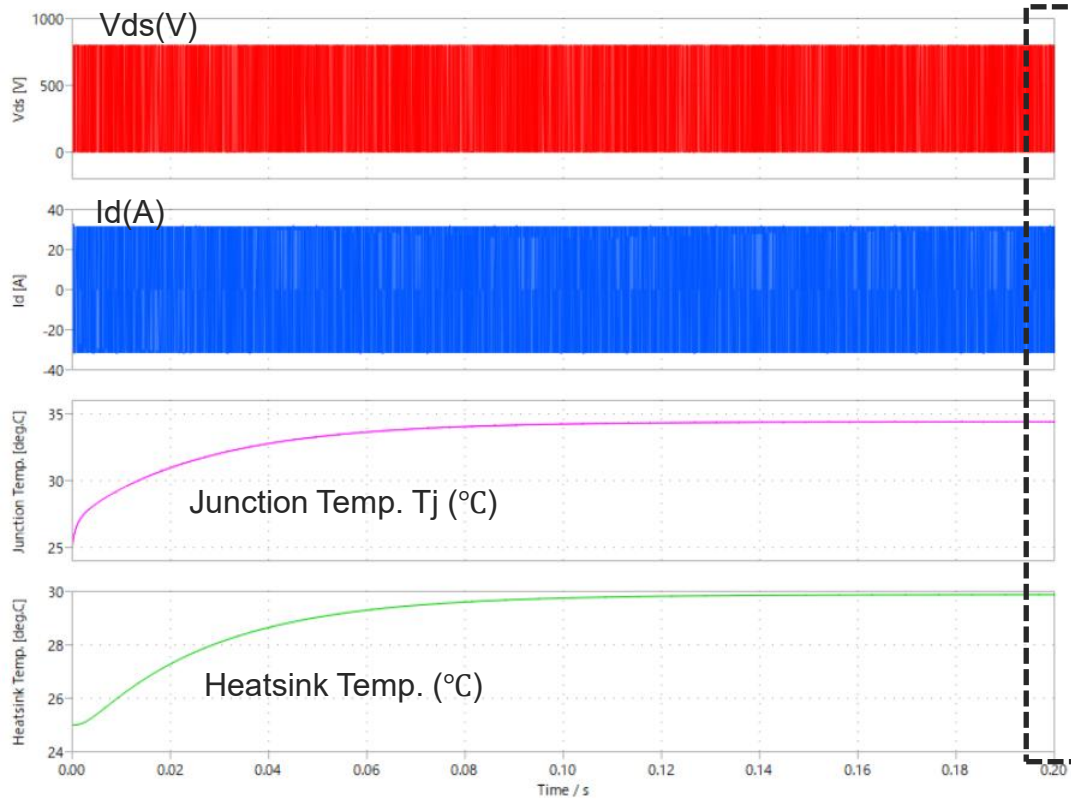
Input and Output



Contents	Results
Input Power : Pin	10.140 (kW)
Output Power: Pout	9.915 (kW)
Efficiency: η	97.79 (%)

Simulation Results 2

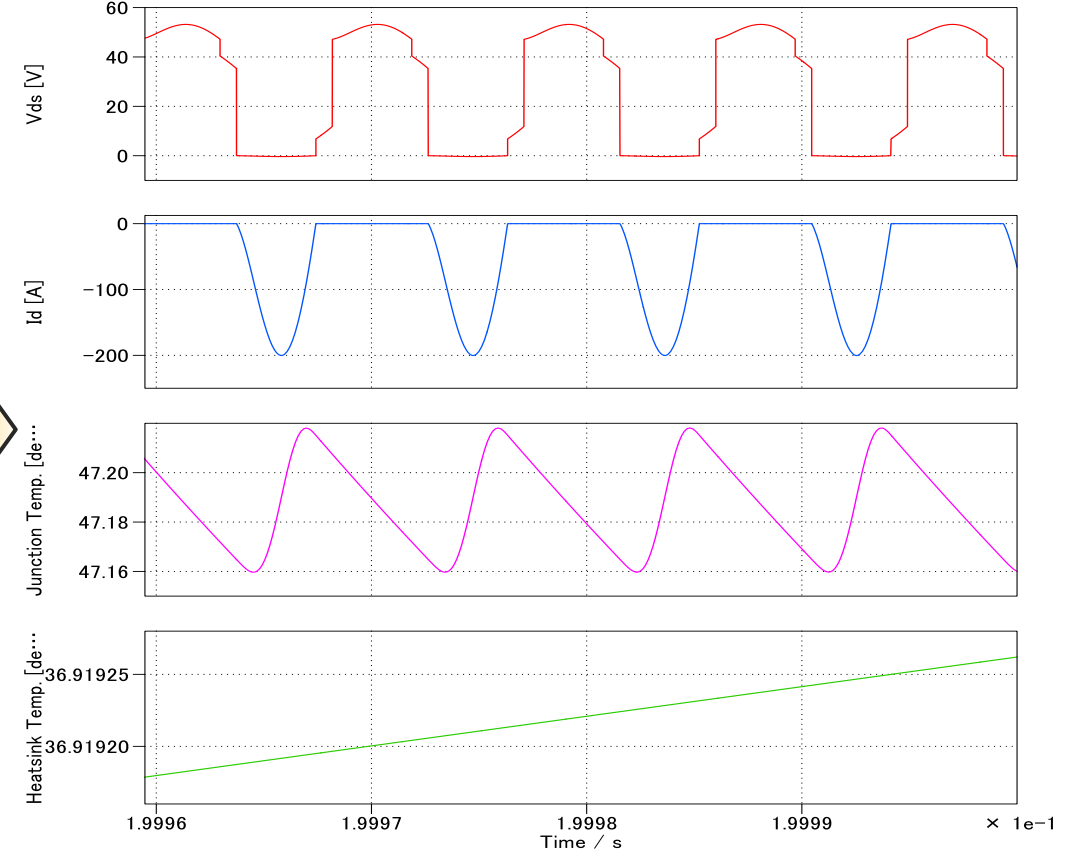
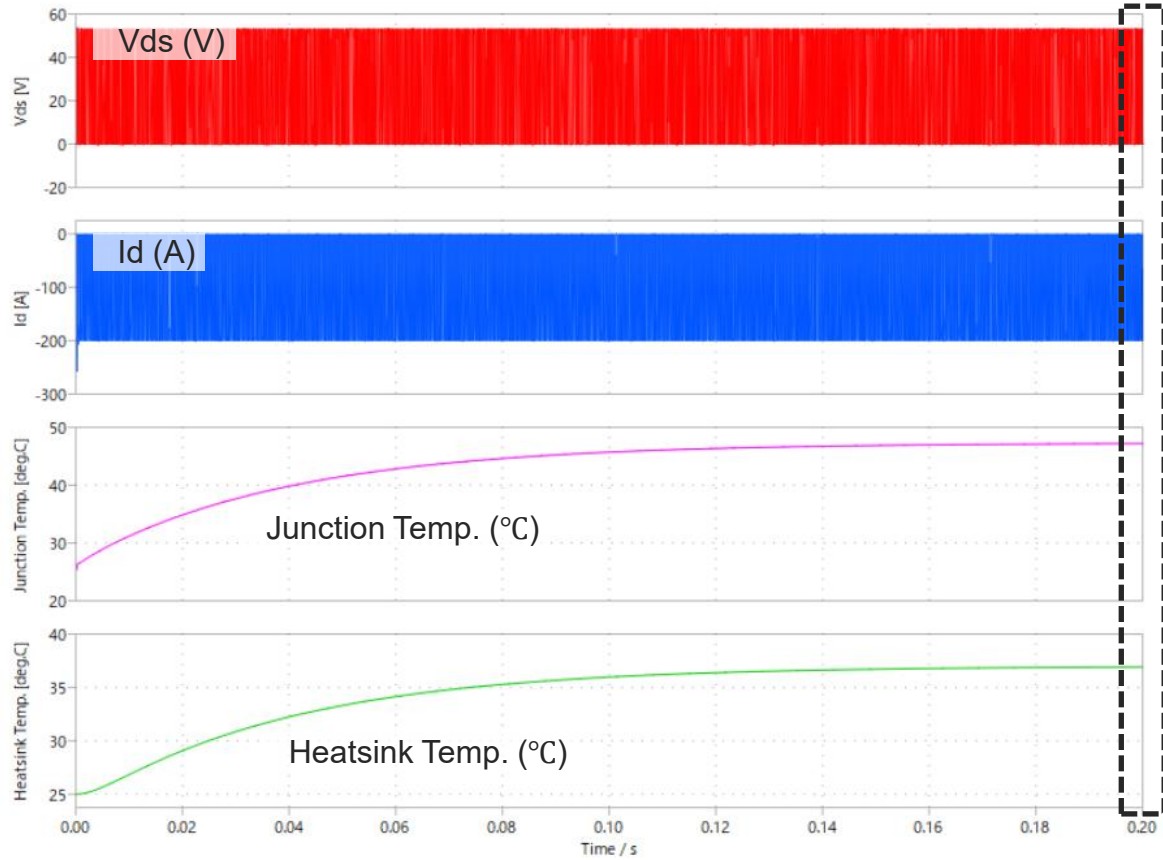
Primary side



Contents	Results
Conduction Loss: Pcond (primary)	6.33 (W/device)
Switching Loss: Psw (primary)	5.78 (W/device)
Junction Temp.: Tj (primary)	34.39 (°C)
Heatsink Temp.: T_hs (primary)	29.88 (°C)
Total Loss: Ptot (primary)	48.44 (W)

Simulation Results 3

Secondary side



Contents	Results
Conduction Loss: Pcond (secondary)	14.70 (W/device)
Junction Temp. : Tj (secondary)	47.19 (°C)
Heatsink Temp.: T_hs (secondary)	36.92 (°C)
Total Loss: Ptot (secondary)	117.64 (W)

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

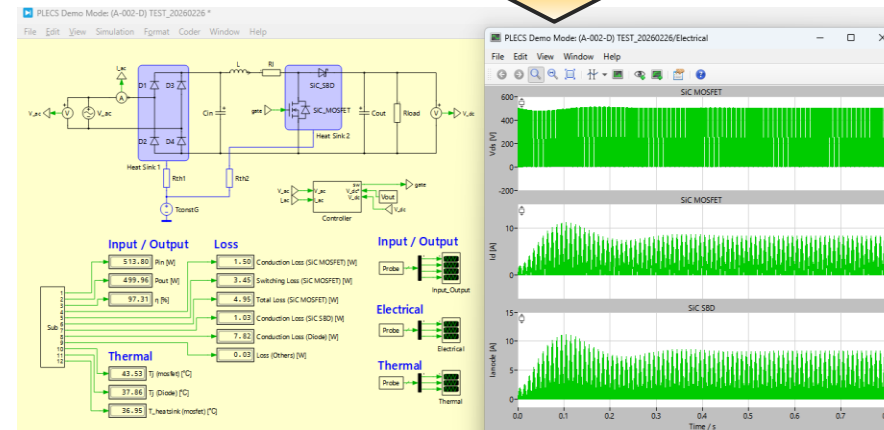
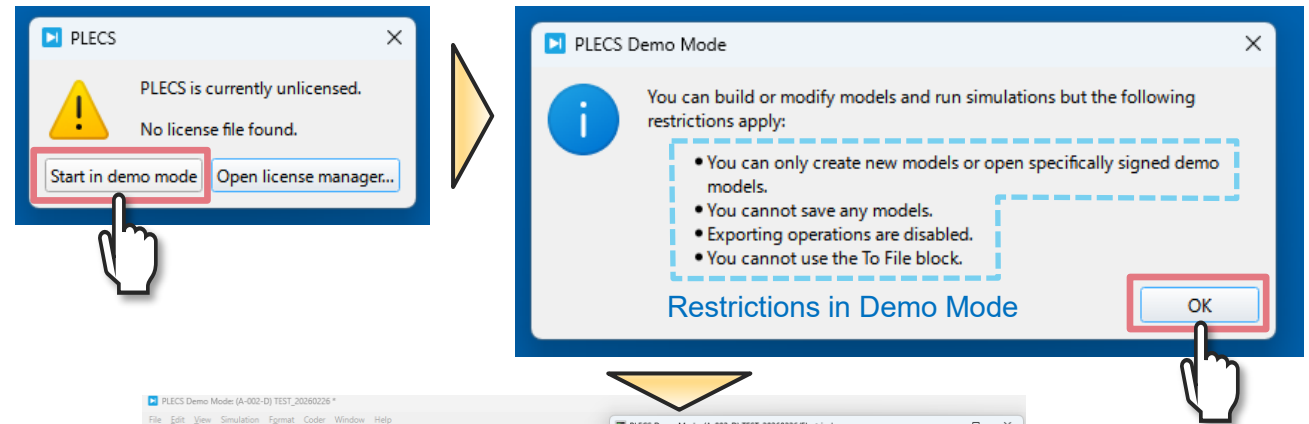
1. Obtaining the Software

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

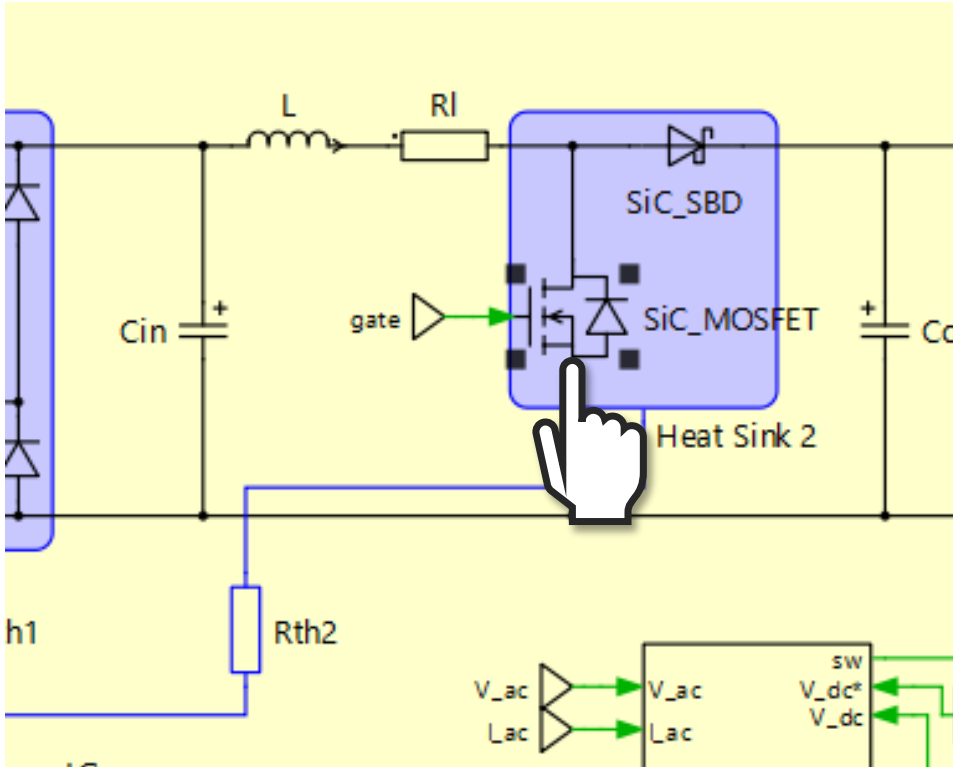
<https://www.plexim.com/download>

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.



Schematic window



Block Parameters: (A-002-D) AC-DC Boost PFC Diode Rectific... X

SiC-MOSFET (mask)

Model Generated by ROHM
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Date: 21-Jan.-2026

Parameters Assertions

SiC-MOSFET:
SiCMOS

Custom variables:
struct('Rg_on', 'Rg_on', 'Rg_off', 'Rg_off', 'sw', 'sw')

Gate resistance (on):
Rg_on

Gate resistance (off):
Rg_off

Initial temperature:
T_init

Initial Ron:
Ron_init

OK Cancel Apply Help

- From library...
- By reference
- Edit...
- Remove
- New thermal description...
- New thermal package description...

[SiC-MOSFET] TO-247-4L_750V_25A_65mΩ (SCT4065DR)
[SiC-MOSFET] TO-247-4L_750V_34A_45mΩ (SCT4045DR)
[SiC-MOSFET] TO-247-4L_750V_42A_36mΩ (SCT4036DR)
[SiC-MOSFET] TO-247-4L_750V_56A_26mΩ (SCT4026DR)
[SiC-MOSFET] TO-247N_1200V_19A_90mΩ (SCT4090KE)
[SiC-MOSFET] TO-247N_1200V_26A_62mΩ (SCT4062KE)
[SiC-MOSFET] TO-247N_1200V_32A_50mΩ (SCT4050KE)
[SiC-MOSFET] TO-247N_1200V_40A_36mΩ (SCT4036KE)
[SiC-MOSFET] TO-247N_1200V_81A_18mΩ (SCT4018KE)
[SiC-MOSFET] TO-247N_750V_105A_13mΩ (SCT4013DE)
[SiC-MOSFET] TO-247N_750V_25A_65mΩ (SCT4065DE)
[SiC-MOSFET] TO-247N_750V_34A_45mΩ (SCT4045DE)
[SiC-MOSFET] TO-247N_750V_42A_36mΩ (SCT4036DE)
[SiC-MOSFET] TO-247N_750V_56A_26mΩ (SCT4026DE)
[SiC-MOSFET] TO-263-7LA_1200V_17A_90mΩ (SCT4090KWA)
[SiC-MOSFET] TO-263-7LA_1200V_24A_62mΩ (SCT4062KWA)
[SiC-MOSFET] TO-263-7LA_1200V_29A_50mΩ (SCT4050KWA)
[SiC-MOSFET] TO-263-7LA_1200V_40A_36mΩ (SCT4036KWA)
[SiC-MOSFET] TO-263-7LA_1200V_75A_18mΩ (SCT4018KWA)
[SiC-MOSFET] TO-263-7LA_750V_22A_65mΩ (SCT4065DWA)
[SiC-MOSFET] TO-263-7LA_750V_31A_45mΩ (SCT4045DWA)
[SiC-MOSFET] TO-263-7LA_750V_38A_36mΩ (SCT4036DWA)
[SiC-MOSFET] TO-263-7LA_750V_51A_26mΩ (SCT4026DWA)
[SiC-MOSFET] TOLL_750V_120A_13mΩ (SCT4013DLL)
[SiC-MOSFET] TOLL_750V_26A_65mΩ (SCT4065DLL)
[SiC-MOSFET] TOLL_750V_37A_45mΩ (SCT4045DLL)

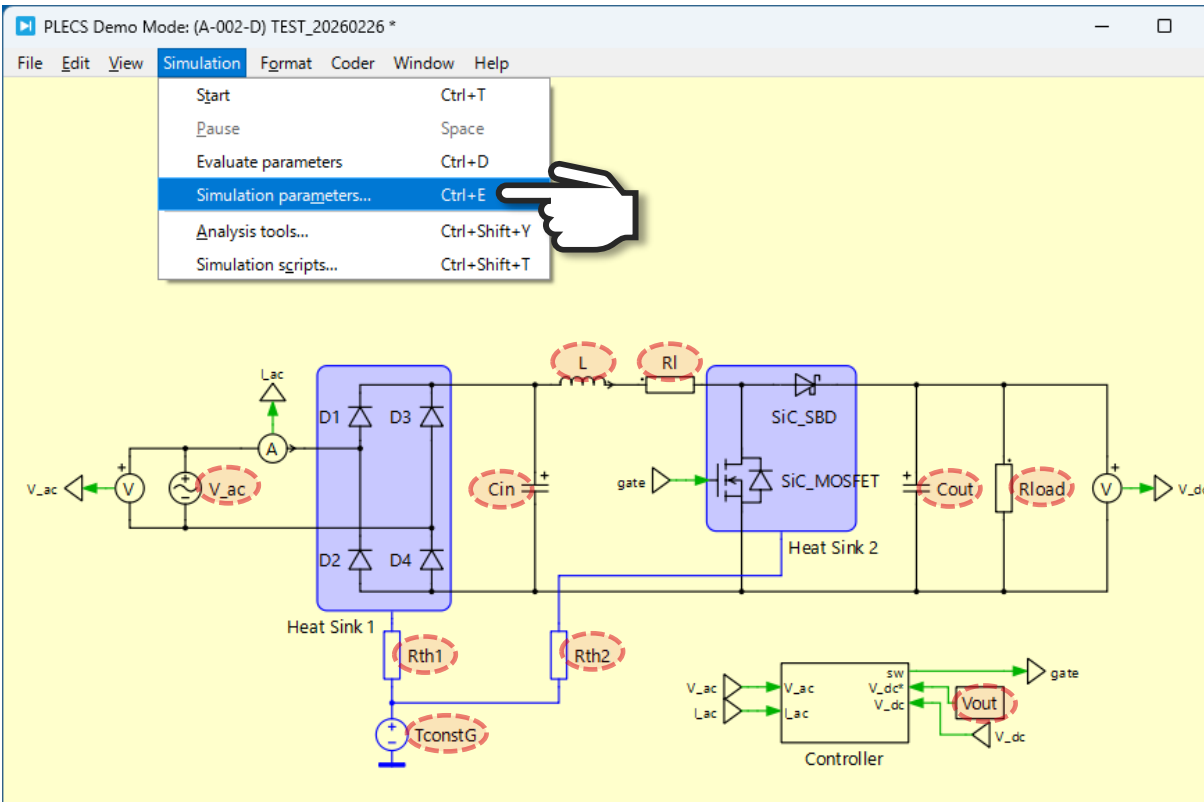
Hover your mouse cursor over the device symbol that you want to change and double-click the left button of the mouse.

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

Schematic window



```
1 % General|
2 Test time = 0.8; % End time of simulation [s]
3 SiCMOS = 'file:SC14065DR';
4 SiCSBD = 'file:SCS320AG';
5
6 % Grid
7 Vin = 100;
8 %Wac = Vin*sqrt(2); % Grid voltage [V]
9 Vout = 500
10 F = 50.0; % Grid frequency [Hz]
11
12 % Plant
13 fs_k = 50; % Switching frequency [kHz]
14 %fs = fs_k*1e3; % Switching frequency [Hz]
15
16 RL = 0.001
17 Rload = 500; % Load resistance [ohms]
18 Rsense = 0.0025; % Sense resistance [ohms]
19 L = 1e-3; % Choke inductance [H]
20 Cin = 0.1e-6; % Input capacitor [C]
21 Cout = 1e-3; % Output capacitor [C]
22 C1 = 470e-9; % Reference capacitor [C]
23
24 %Wcout_init = Vout; %Initial Voltage of Output Capacitor [V]
25
26
27 R_Di = 0.02; % Diode On-resistance [ohm]
28 V_F_Di = 0.6; % Diode On-resistance [ohm]
29
30 % Thermal system
31 T_init = 25; % Initial Temperature of Heatsink [deg.C]
32 Thcap_1 = 0.001; % Thermal capacitance of Heatsink [J/K]
33 Thcap_2 = 0.001; % Thermal capacitance of Heatsink [J/K]
34 Rth_1 = 2.0; % Thermal Resistance [K/W]
35 Rth_2 = 2.0; % Thermal Resistance [K/W]
36 T_GND = 25; %Thermal GND Temperature [deg.C]
37
```

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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