

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

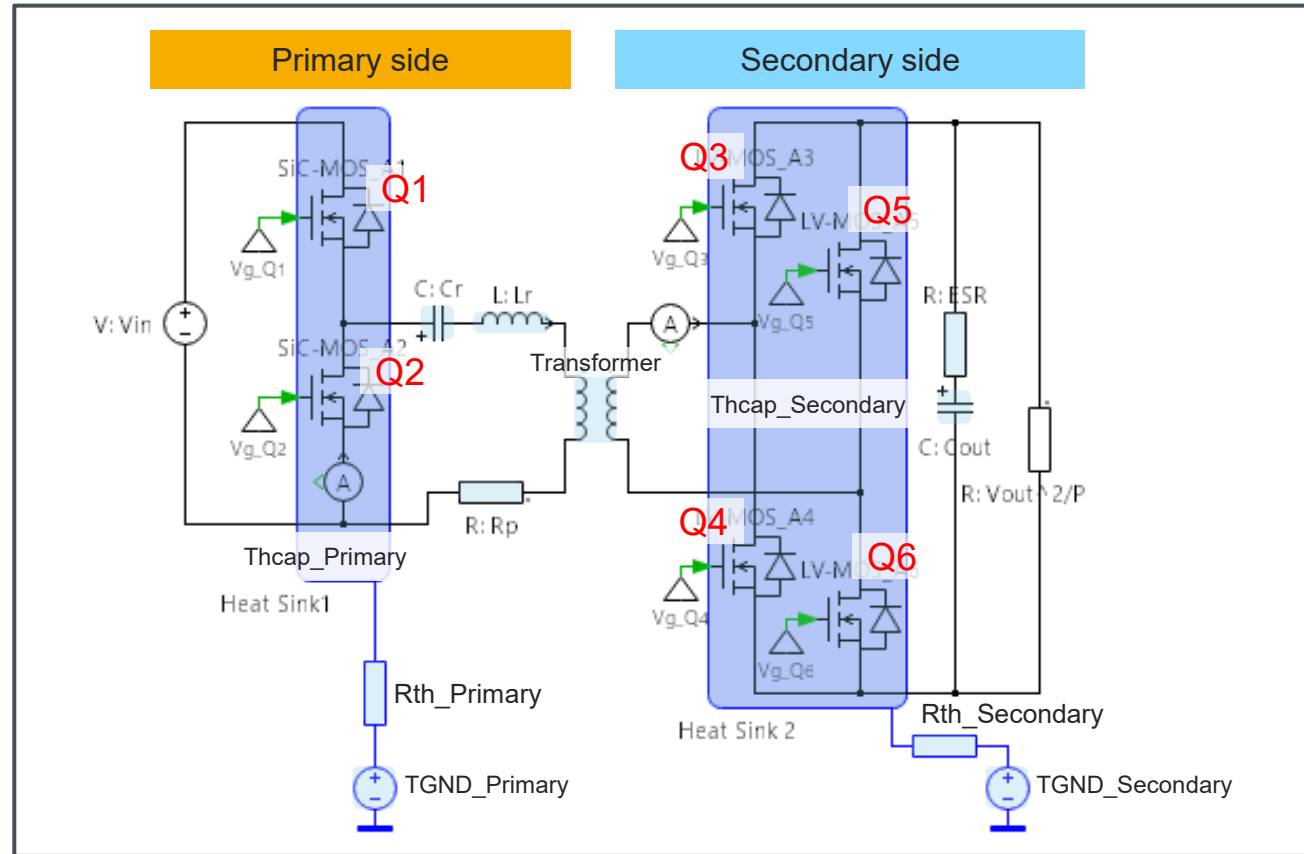
## Simulation Parameters

Name	Content	unit	Default Value	Variable Range
Transformer	Np: Primary-turns	turns	9	1 ~ 1,000
	Ns: Secondary-turns	turns	1	1 ~ 1,000
	Lm: Magnetizing Inductance	H	60u	1n~1
Rp	Transformer Resistance	$\Omega$	2m	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	$\Omega$	15m	1m ~ 1
Primary	Thcap_Primary	J/K	0.1	1m ~ 100
	Rth_Primary	K/W	0.2	1m ~ 100
	TGND_Primary	Ambient Temperature	$^{\circ}\text{C}$	25
Secondary	Thcap_Secondary	J/K	0.1	1m ~ 100
	Rth_Secondary	K/W	0.2	1m ~ 100
	TGND_Secondary	Ambient Temperature	$^{\circ}\text{C}$	25

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)	$\Omega$	2	0.1 ~ 100
	Rg_off 1*	Gate Resistance (Sink)	$\Omega$	1	0.1 ~ 100
	DT1	Dead Time	s	200n	0 ~ 1m
Secondary	Rg_on 2*	Gate Resistance (Source)	$\Omega$	10	0.1 ~ 100
	Rg_off 2*	Gate Resistance (Sink)	$\Omega$	10	0.1 ~ 100
	DT2	Dead Time	s	200n	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

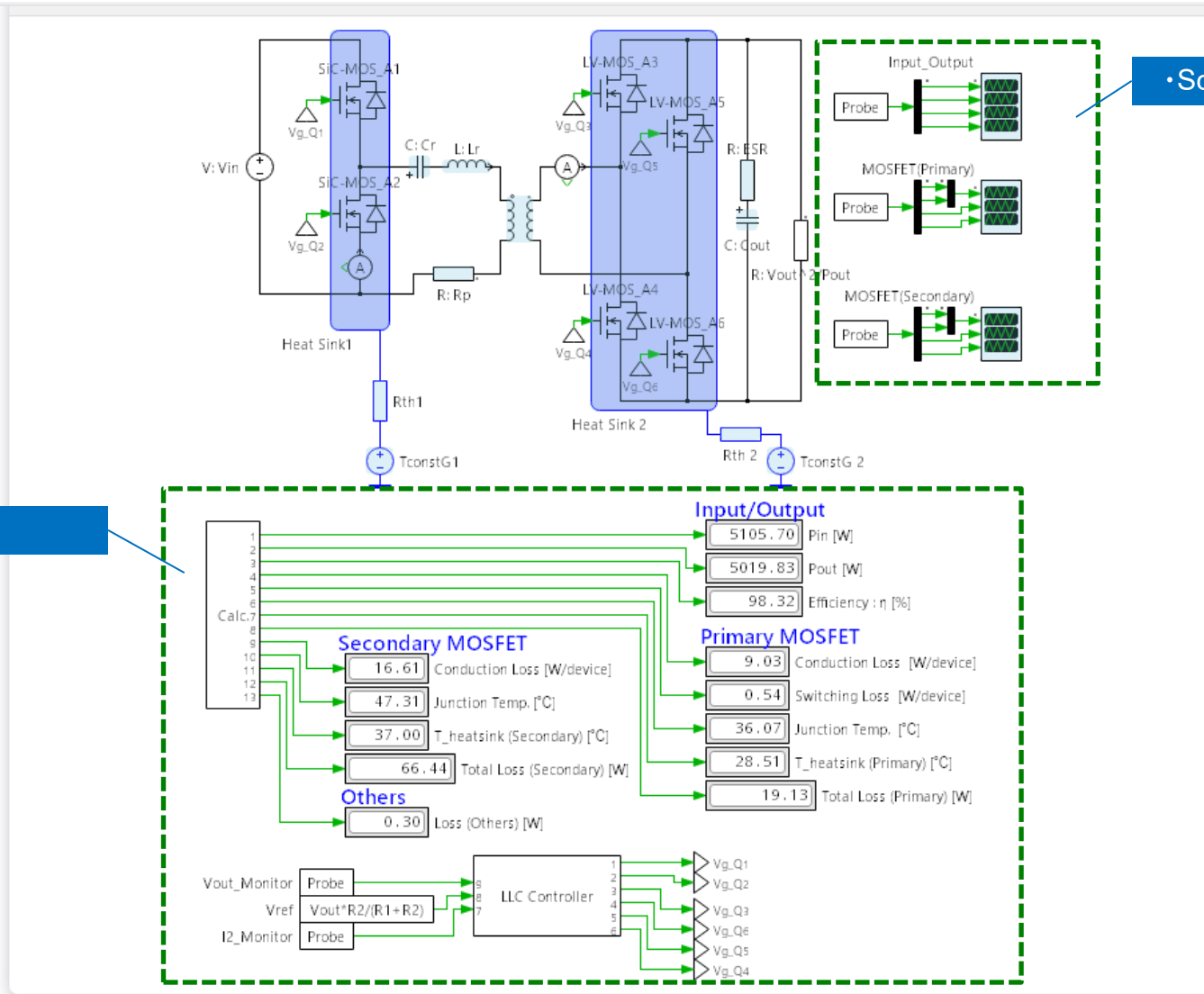
## Simulation Circuit



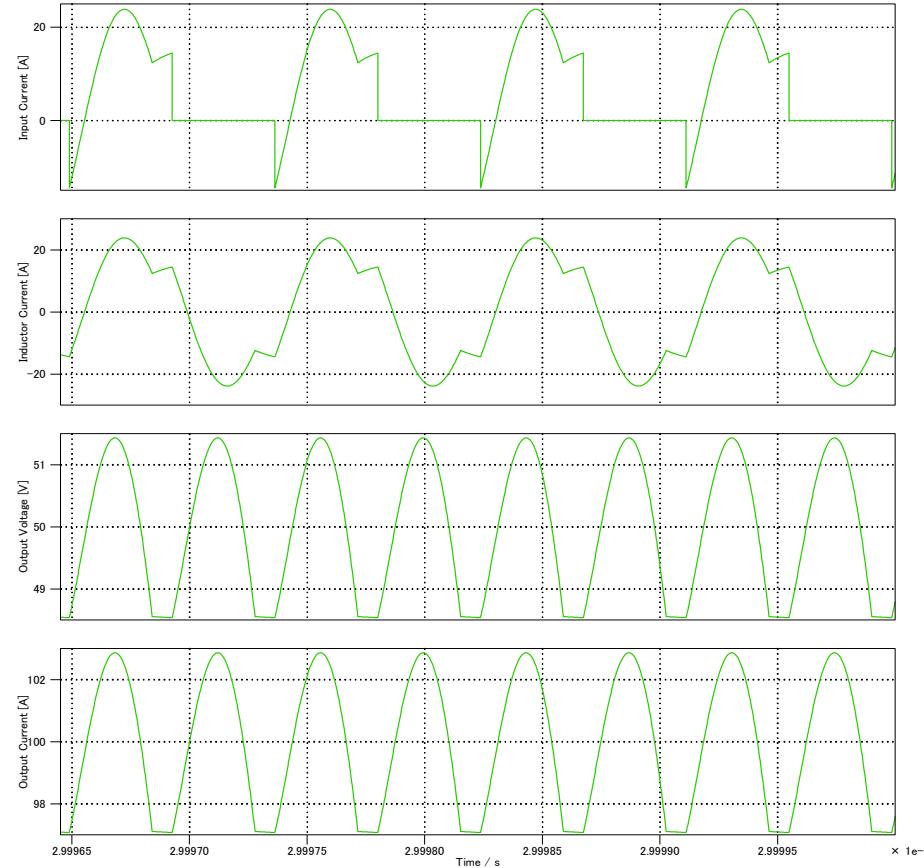
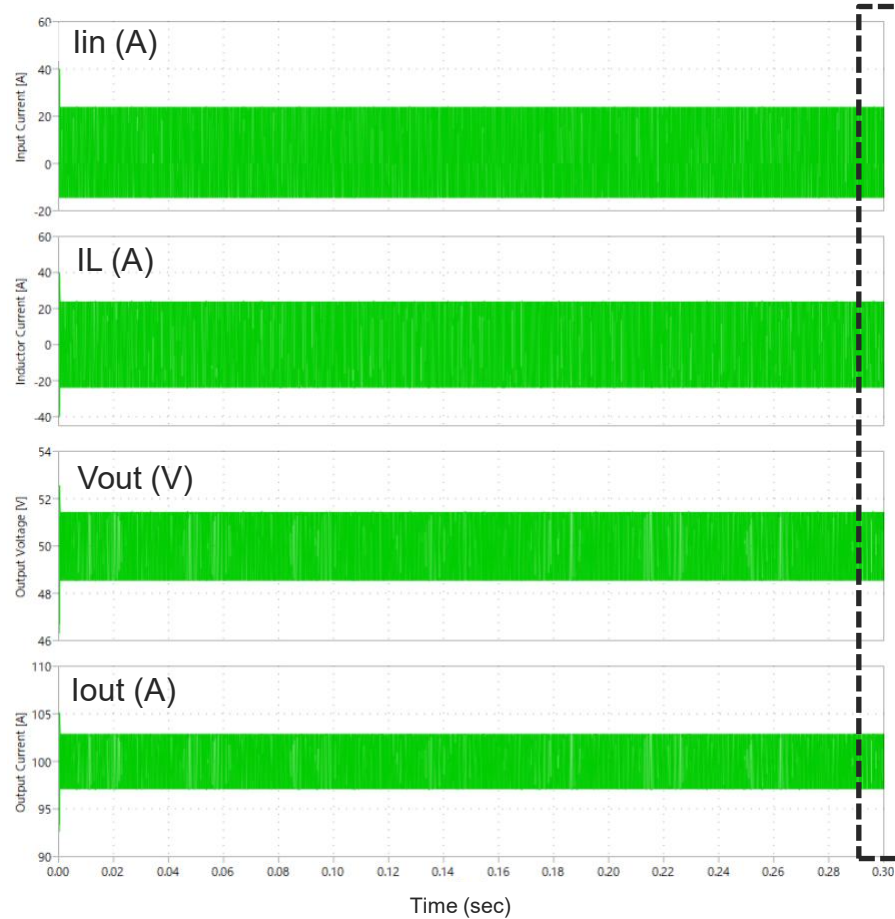
## Default Devices

Name	Device Type	Part No.	Specification
Q1,2	SiC MOSFET	SCT4050KR	1200V/ 32A/ 50m $\Omega$ / TO-247-4L
Q3~6	Si MOSFET	RS7N200BH	80V/ 200A/ 1.7m $\Omega$ / DFN5060-8S

## Schematic window

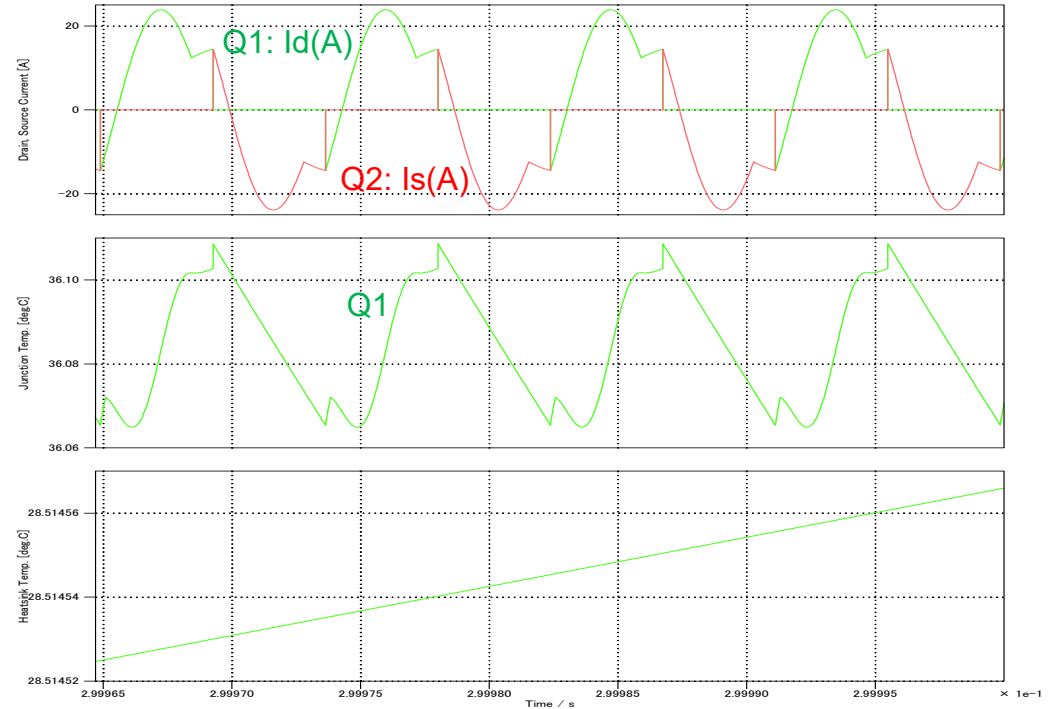
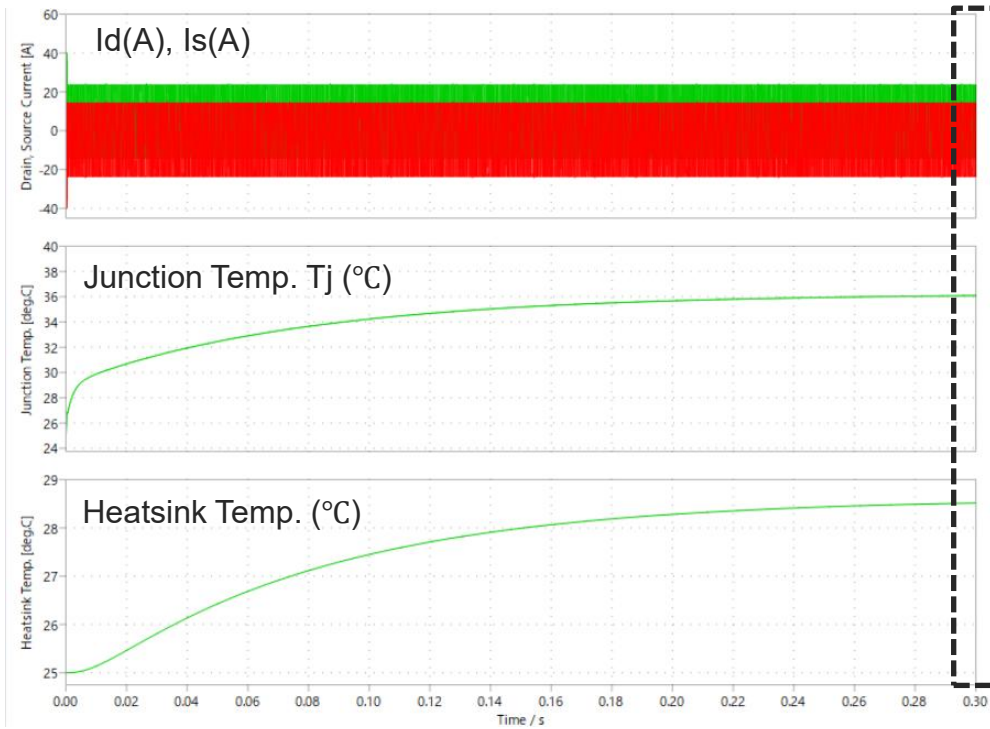


## Input and Output



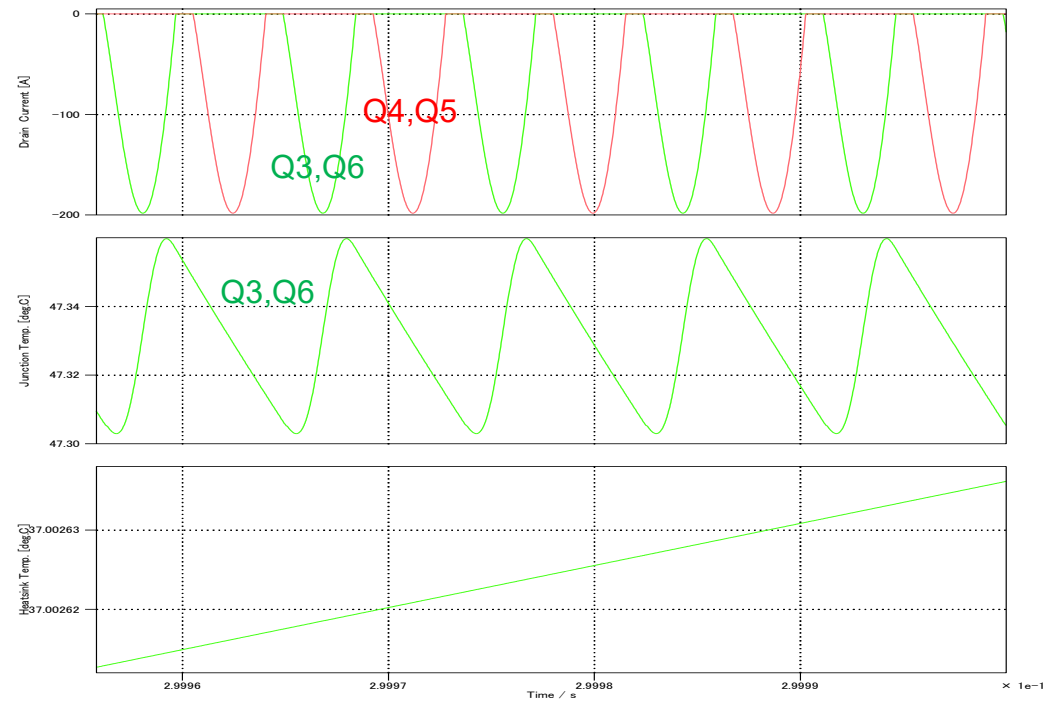
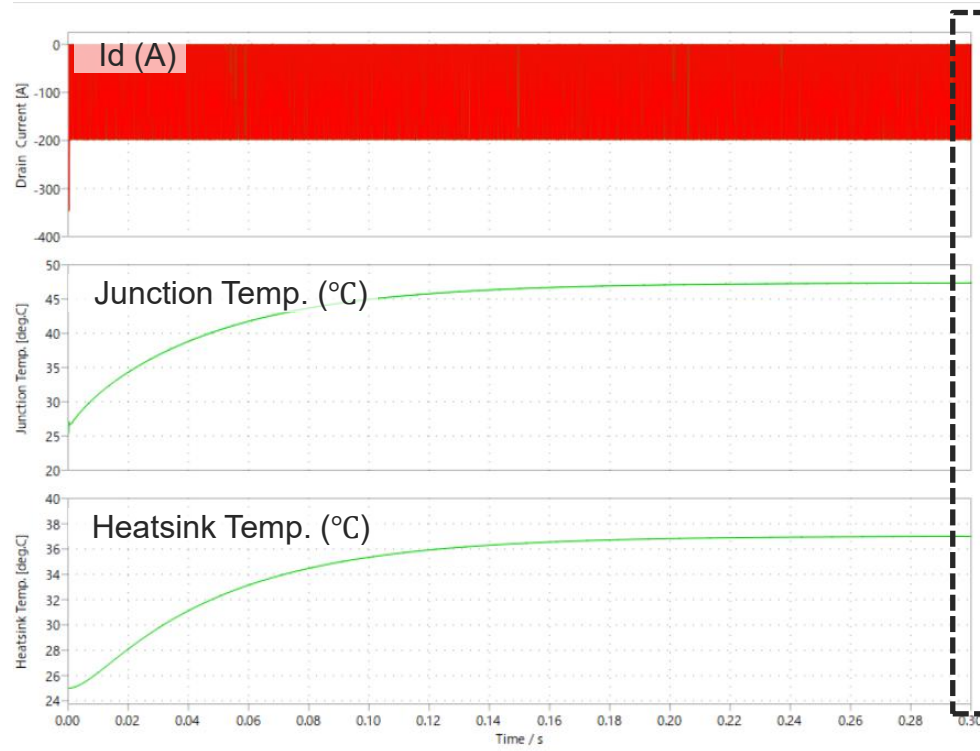
Contents	Results
Input Power : Pin	5.110 (kW)
Output Power: Pout	5.006 (kW)
Efficiency: $\eta$	97.98 (%)

## 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 (°C)
Heatsink Temp.: T_hs (primary)	28.54 (°C)
Total Loss: Ptot (primary)	17.35 (W)

## Secondary side



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

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

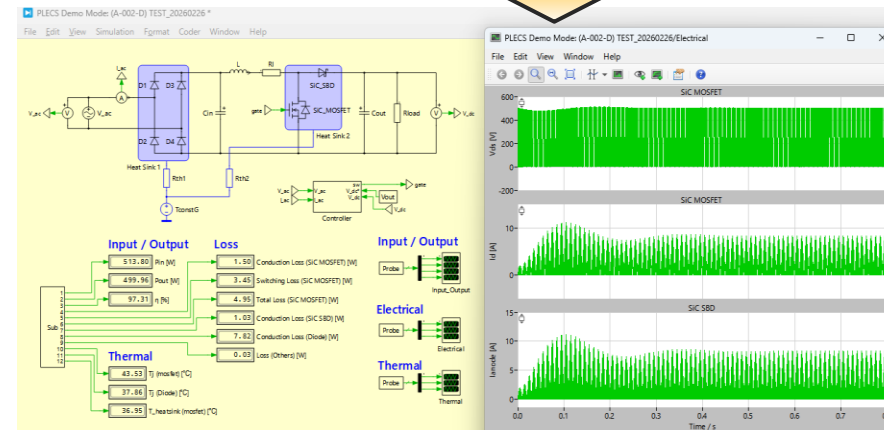
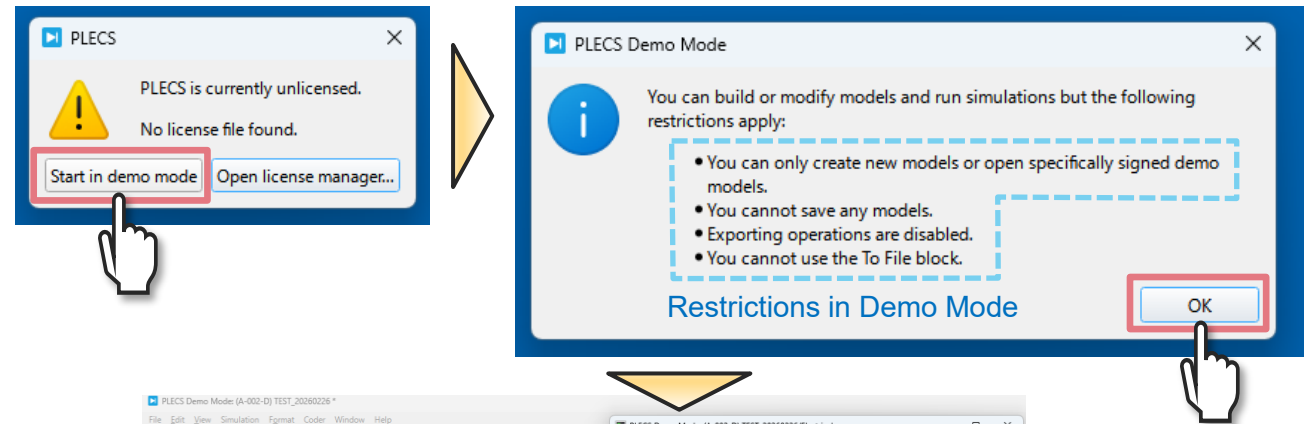
## 1. Obtaining the Software

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

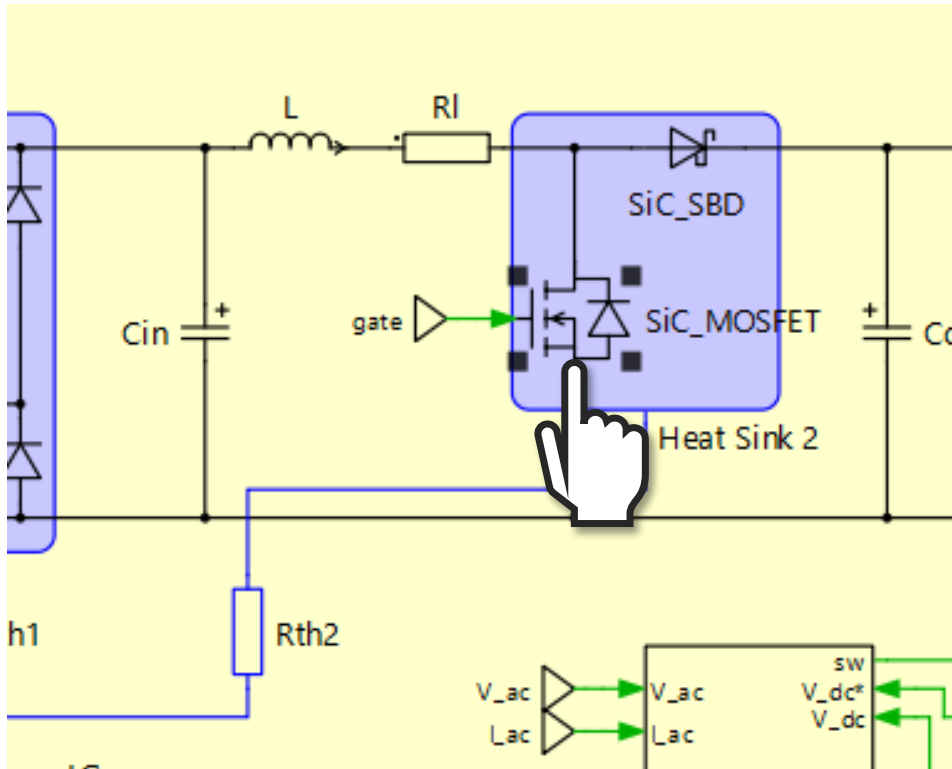
<https://www.plexim.com/download>

## 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 (SCT4026DWW)  
[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.

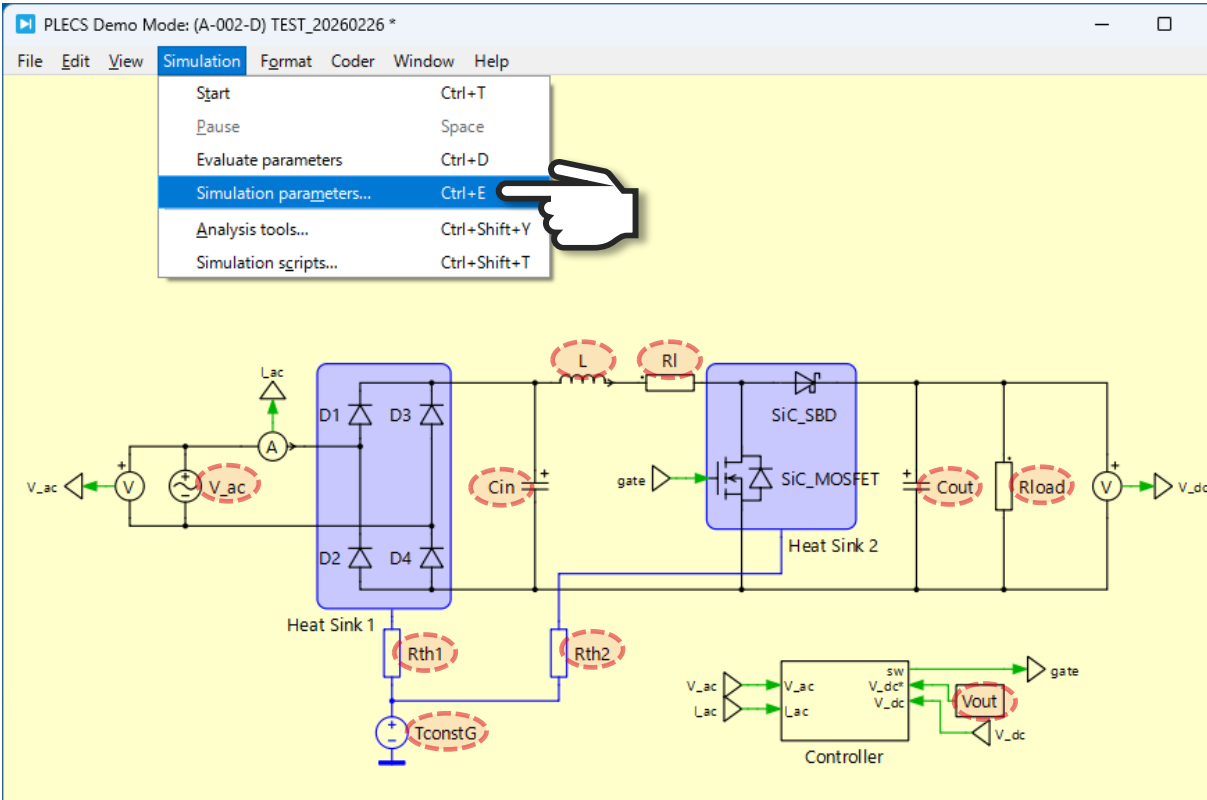
Click "... " > "From library..." to view the list of available devices and you can select a favorite device from these.

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



The screenshot shows the "Simulation Parameters: (A-002-D) TEST\_20260226" dialog box. The "Initialization" tab is active. The "System state" section has "Initialize from:" set to "Block parameters". The "Model initialization commands" section contains a list of parameterized commands, with a red box highlighting the following code:

```
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 TGN0 = 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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