

# (C-012-DOT) DC-DC LLC Half-Bridge Buck Converter (DOT247)

## Simulation Parameters (Dialog)

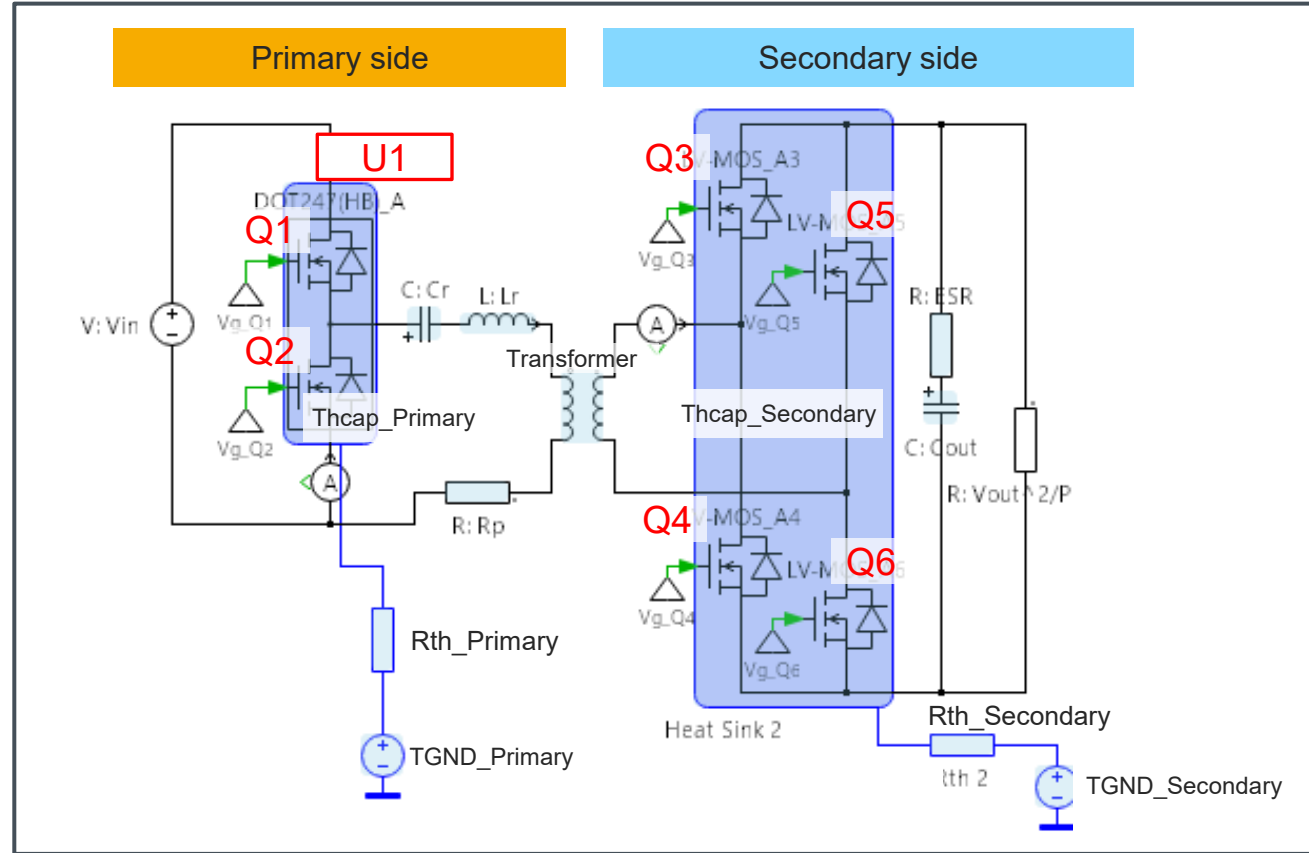
Name	Content	unit	Default Value	Variable Range
Transformer	Np: Primary-turns	turns	9	1 ~ 1,000
	Ns: Secondary-turns	turns	1	1 ~ 1,000
	Lm: Magnetizing Inductance	H	60u	1n~1
Rp	Transformer Resistance	Ω	1m	1m ~ 1
Lr	Resonant Inductance	H	12u	1n ~ 1
Cr	Resonant Capacitance	F	100n	1n ~ 1
Cout	Output Capacitance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

## Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range	
Test_time	Test time in simulation	s	0.3	10u~ 0.5	
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	15	0.1 ~ 100
	Rg_off 1*	Gate Resistance (Sink)	Ω	5.6	0.1 ~ 100
	DT1	Dead Time	s	200n	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	200n	0 ~ 1m
T_init**	Initial Junction Temp.	°C	25	-40 ~ 175	

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

## Simulation Circuit



## Power Devices

Name	Device Type	Part No.	Specification
U1	SiC MOSFET module	SCZ4006KTA	1200V/ 209A/ 6mΩ/ DOT247 (Half-bridge)
Q3~6	Si MOSFET	RS7N200BH	80V/ 200A/ 1.7mΩ/ DFN5060-8S

Schematic window

- Dialog parameters setting
- Results display

Simulation control

Trace selection

Table parameters setting

The screenshot displays the ROHM PLECS Simulator interface, which is divided into several functional areas:

- Schematic window:** Shows a detailed circuit diagram of an LLC converter. A text box above it states: "Clicking blue-colored symbols will allow you to change the parameters." Below the schematic is an "Input/Output" table and a "Secondary MOSFET" table.
- Waveforms:** A vertical stack of four plots on the right side:
  - Input Current [A]: Shows a high-frequency AC waveform.
  - Inductor Current [A]: Shows a high-frequency AC waveform.
  - Output Voltage [V]: Shows a high-frequency AC waveform.
  - Output Current [A]: Shows a high-frequency AC waveform.
- Simulation control:** A panel with buttons for "Startup", "Steady-state", "Hold Result", and "Simulation Completed".
- Trace selection:** A panel showing the selected trace: "[file:SC24006AKTA], RS7N200BH (80V/1.7mQ/DFN5060-8S), Trace 1".
- Table parameters setting:** A table with columns for "Parameter" and "Value".
- Temperature plots:** Two plots at the bottom right showing "Junction Temp." and "Heatsink Temp. (deg. C)" over time.

Parameter	Value
Test_time	0.3 sec
Vin_dc	800 V
Vout_dc	50 V
Output Power	5000 W
Carrier Frequency (Design Value)	100000 Hz

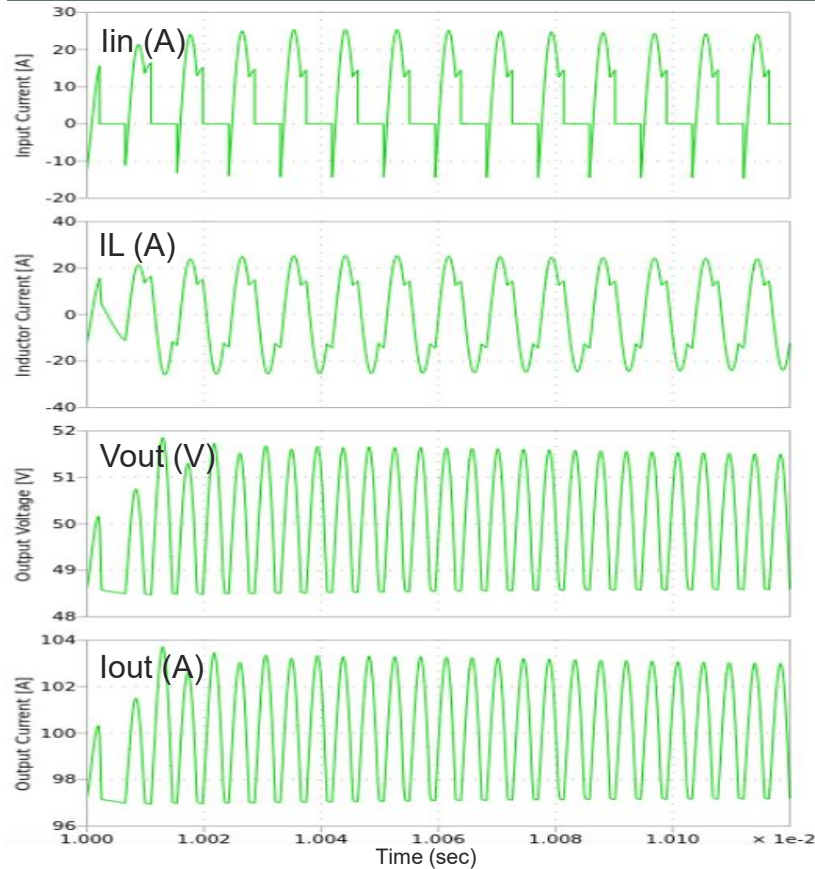
Waveforms

# Simulation Results

Simulation Mode: Steady State

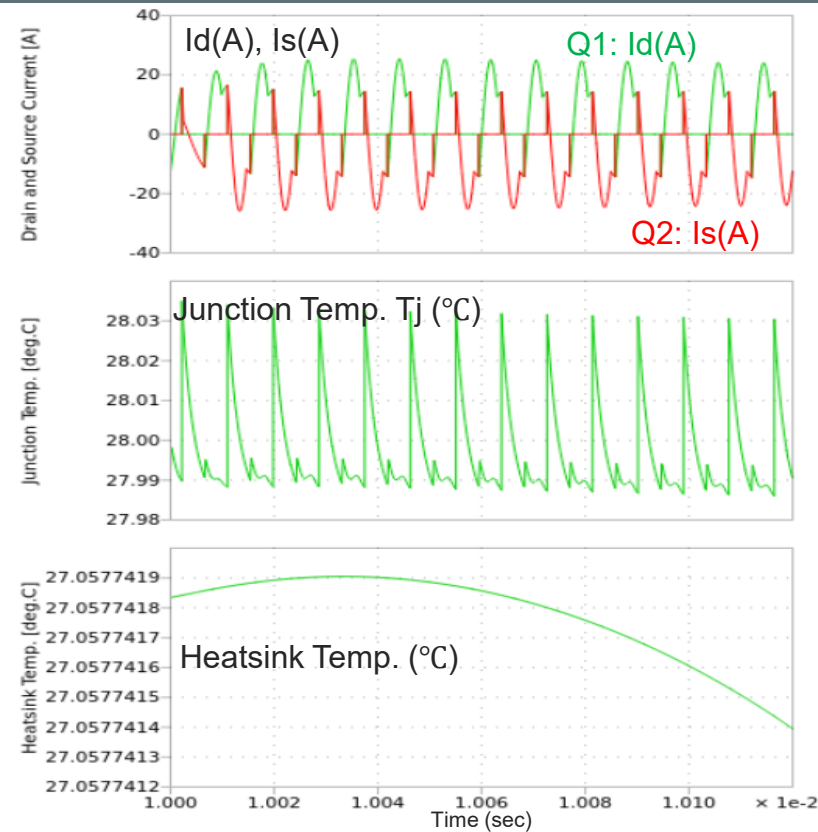
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## Input and Output



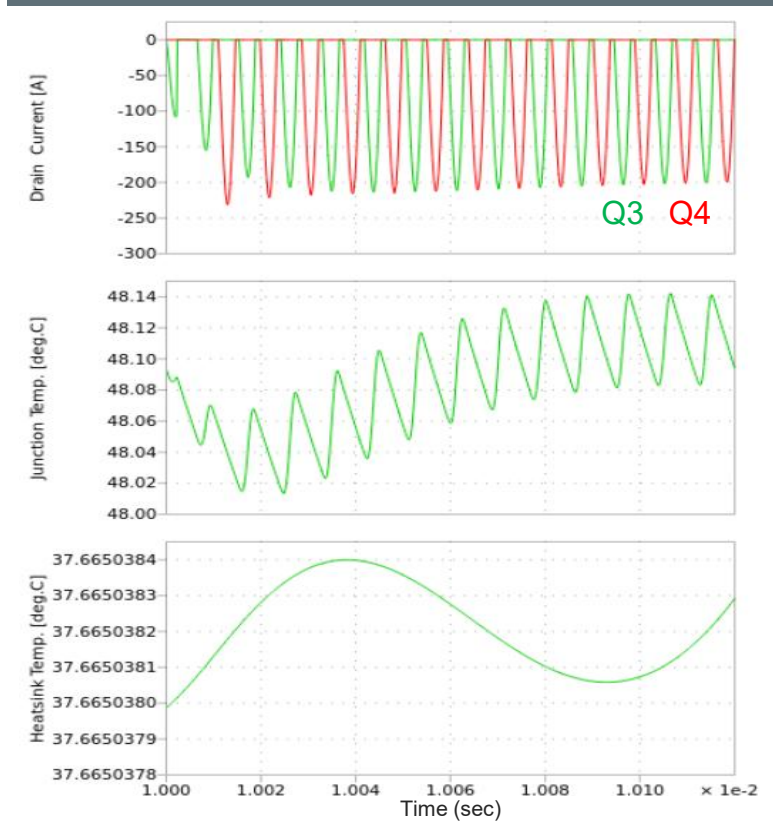
Contents	Results
Input Power : Pin	5.098 (kW)
Output Power: Pout	5.014 (kW)
Efficiency: $\eta$	98.35 (%)

## Primary side



Contents	Results
Conduction Loss: Pcond (primary)	1.33 (W/device)
Switching Loss: Psw (primary)	3.94 (W/device)
Junction Temp. : Tj (primary)	27.99 (°C)
Heatsink Temp.: T_hs (primary)	27.06 (°C)
Total Loss: Ptot (primary)	10.54 (W)

## Secondary side



Contents	Results
Conduction Loss: Pcond (secondary)	14.10 (W/device)
Junction Temp. : Tj (secondary)	48.09 (°C)
Heatsink Temp.: T_hs (secondary)	37.67 (°C)
Total Loss: Ptot (secondary)	56.40 (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.

You can select the simulation devices at "Step-2: Device Selection"

**Step 2: Device Selection**

Please check the checkboxes of the devices you want to simulate (Square checkboxes allow you to select up to three devices simultaneously.)

You can also select IDEAL devices (no-loss).

In addition, clicking PDF icon will allow you to view the datasheet of the certain device.

Selected device names are shown here.

Parameter	Value
$V_{DSS}$	750V
$R_{DS(on)}$ (Typ.)	65mΩ
$I_D^{-1}$	25A
$P_D$	88W

**Features**

- 1) Low on-resistance
- 2) Fast switching speed
- 3) Fast reverse recovery
- 4) Easy to parallel
- 5) Simple to drive
- 6) Pb-free lead plating ; RoHS compliant

# 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.

ROHM PLECS Simulator  
Simulation Example

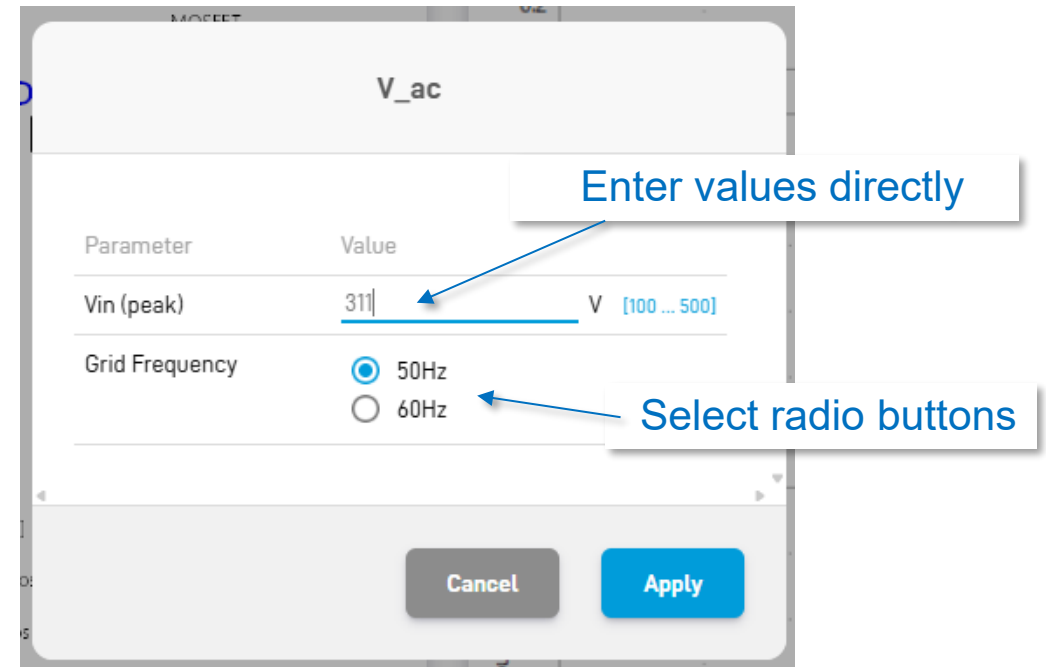


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- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. "V\_ac" symbol in the below).
- Click 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.)

## Table parameters

General Conditions	
Parameter	Value
Test_time	1 sec
Switching Frequency	60000 Hz



General Conditions	
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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