

(A-010-DOT) DC-AC Totem-Pole PFC Synchronous Rectification (DOT247)

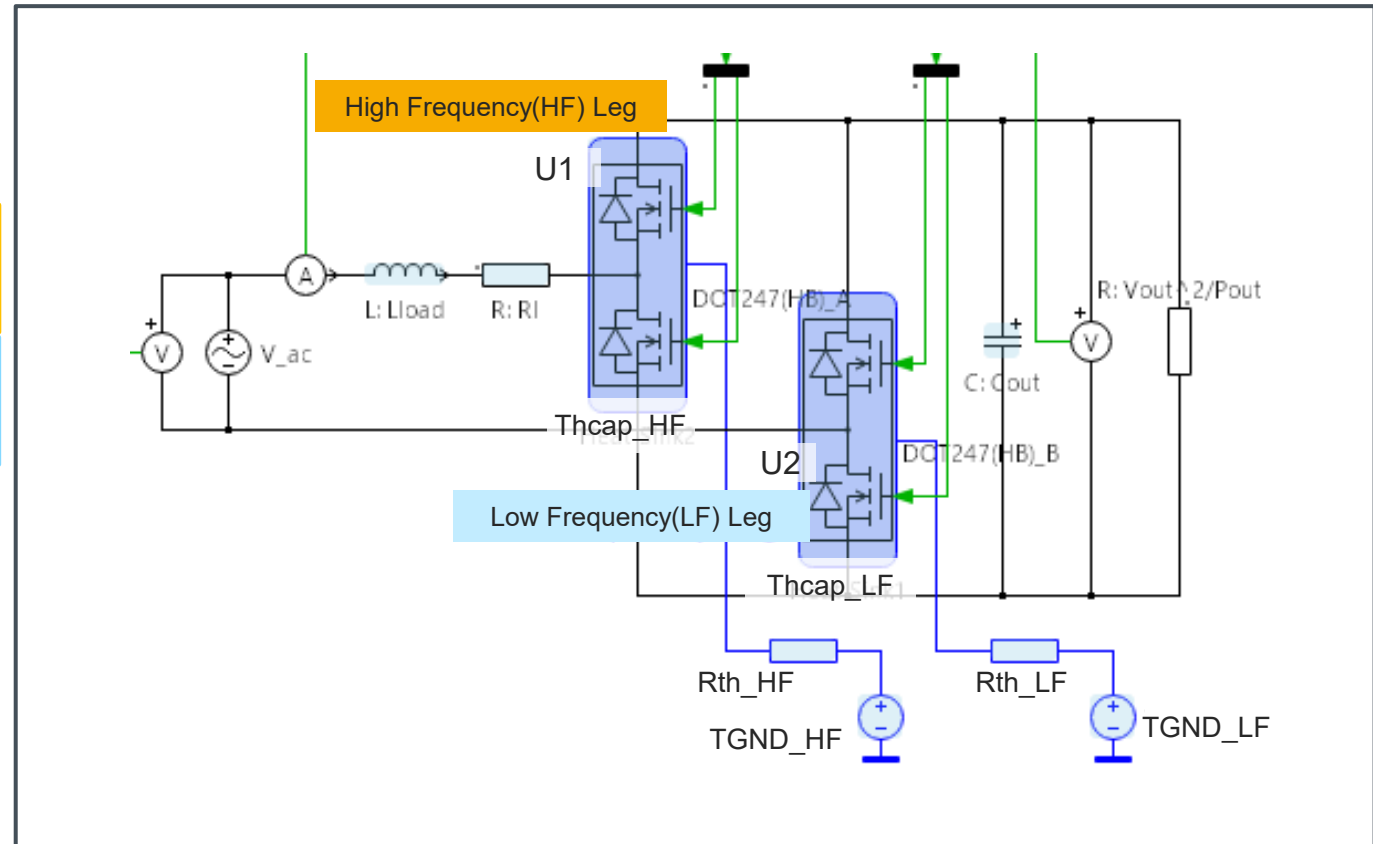
Simulation Parameters (Dialog)

Name	Content	unit	Default Value	Variable Range
Lload	Inductive Load	H	330u	1n ~ 1
RI	Choke Resistance	Ω	5m	1u ~ 100m
Cout	Output Capacitor Initial Voltage	F V	1m 500	1n ~ 1 0 ~ 1200
Thcap_HF	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_HF	Thermal Resistance	K/W	0.5	1m ~ 100
TGND_HF	Thermal GND Temperature	°C	25	-40 ~ 175
Thcap_LF	Thermal Capacitance	J/K	0.1	1m ~ 100
Rth_LF	Thermal Resistance	K/W	0.5	1m ~ 100
TGND_LF	Thermal GND Temperature	°C	25	-40 ~ 175

Simulation Parameters (Table)

Name	Content	unit	Default Value	Variable Range
Test_time	Test time in simulation	s	0.5	100u ~ 0.5
fs	Switching Frequency	Hz	60k	10k ~ 100k
V_ac (rms)	Input Voltage Grid Frequency	V Hz	220 50	100 ~ 500 50 or 60
Vout	Output Voltage	V	500	300 ~ 1200
Pout	Output Power	W	3,300	100 ~ 30,000
Rg_on (HF)	Gate Resistance (Source)	Ω	15	0.1 ~ 100
Rg_off (HF)	Gate Resistance (Sink)	Ω	15	0.1 ~ 100
DT (HF)	Dead Time (HF)	s	200n	0 ~ 1m
Rg_on (LF)	Gate Resistance (Source)	Ω	15	0.1 ~ 100
Rg_off (LF)	Gate Resistance (Sink)	Ω	15	0.1 ~ 100
DT (LF)	Dead Time (LF)	s	100n	0 ~ 1m
T_init	Initial Junction Temperature	°C	25	-40 ~ 175

Simulation Circuit



Power Devices

Name	Device Type	Part No.	Specification
U1	SiC Power Module	SCZ4008DTA	750V/ 134A/ 8mΩ/ DOT247(Half-bridge)
U2	SiC Power Module	SCZ4004DTA	750V/ 251A/ 4mΩ/ DOT247(Half-bridge)

Simulation Screen Overview

Schematic window

- Dialog parameters setting
- Results display

The screenshot displays the PLECS simulation environment for a half-bridge inverter. The main schematic window shows a circuit with a PFC Controller, High-Freq. Leg, and Low-Freq. Leg. Below the schematic is a table of simulation results:

Input/Output	
Pin [W]	2339.34
Pout [W]	5299.88
η [%]	98.80
Low-Frequency Leg	
T_{diode} [°C]	43.62
T_{heatsink} [°C]	25.55
Conduction Loss [W/device]	0.57
Total Loss [W]	3.14
High-Frequency Leg	
T_{mosfet} [°C]	49.95
T_{heatsink} [°C]	43.77
Conduction Loss [W/device]	1.48
Switching Loss [W/device]	17.44
Total Loss [W]	87.79
Others	
Loss (Others) [W]	1.14

The interface also includes a Simulation Control panel with 'Start-Up', 'Steady-state', and 'Hold Result' buttons. A Traces panel shows the selected simulation file. A parameter settings table is located at the bottom left, and a 'Waveforms' panel on the right shows plots for Vin, Iin, Vout, Iout, and Vds over time.

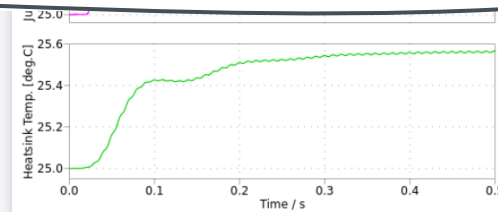
Waveforms

Simulation control

Trace selection

Table parameters setting

[HF-Leg] Rg_off	15	ohm
[HF-Leg] Dead Time	2e-7	sec
[LF-Leg] Rg_on	15	ohm
[LF-Leg] Rg_off	15	ohm
[LF-Leg] Dead Time	1e-7	sec
Initial Junction Temperature	25	deg.C

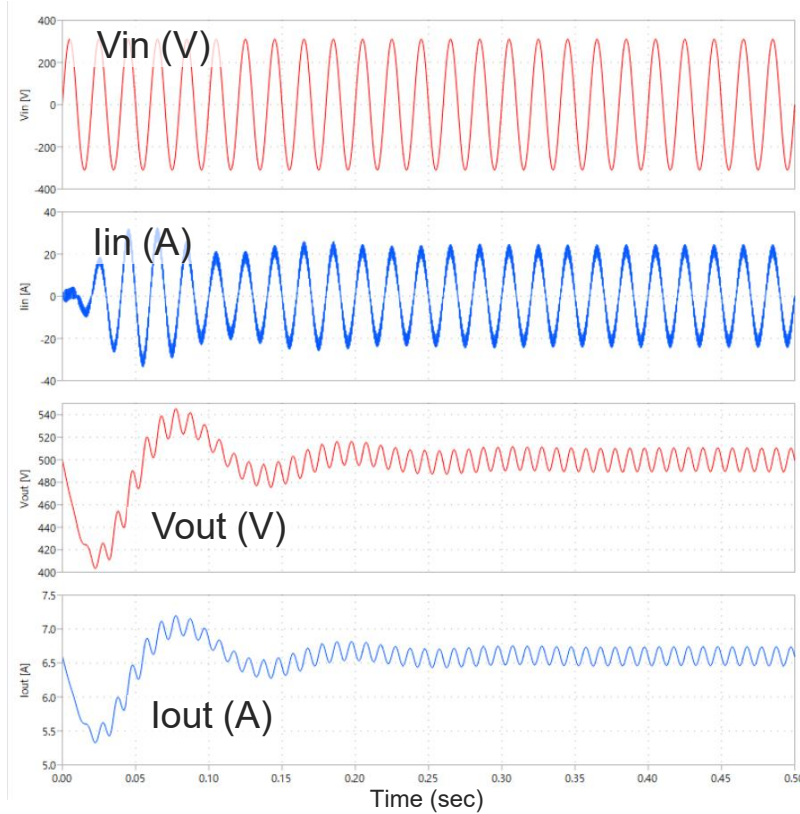


Simulation Results

Simulation Mode: Start-UP

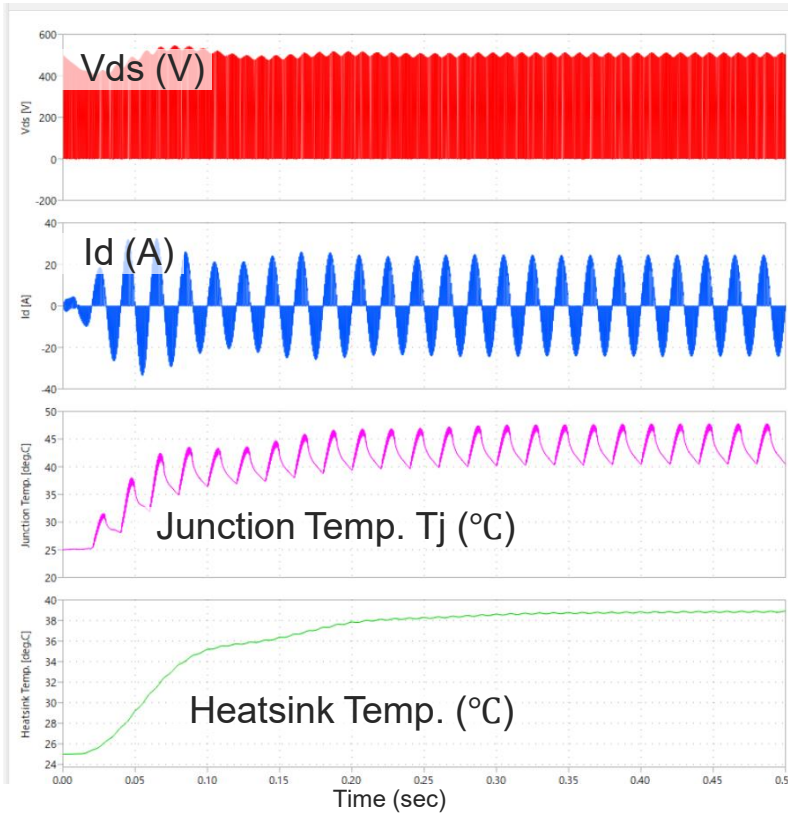
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Input and Output



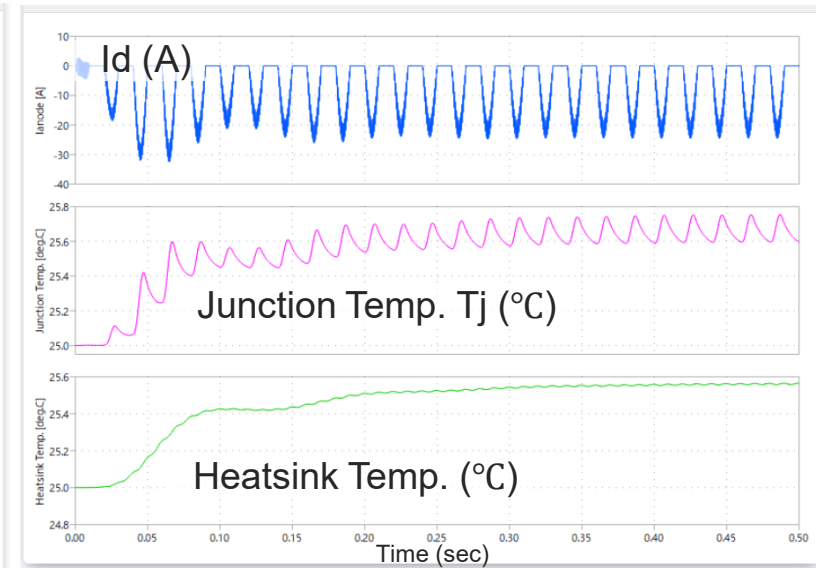
Contents	Results
Input Power : Pin	3339.94 (kW)
Output Power: Pout	3299.88 (kW)
Efficiency: η	98.80 (%)

High-Frequency (HF) Leg



Contents	Results
Junction Temp. Tj (HF)	49.95 (°C)
Heatsink Temp. T_hs (HF)	43.77 (°C)
Conduction Loss: Pcond (HF)	1.46 (W/Leg)
Switching Loss: Psw (HF)	17.44 (W/Leg)
Total Loss: Ptot (HF: Leg1+Leg2)	37.79 (W)

Low-Frequency (LF) Leg



Contents	Results
Junction Temp. Tj (LF)	25.66 (°C)
Heatsink Temp. T_hs (LF)	25.56 (°C)
Total Loss: Ptot (LF)	1.14 (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

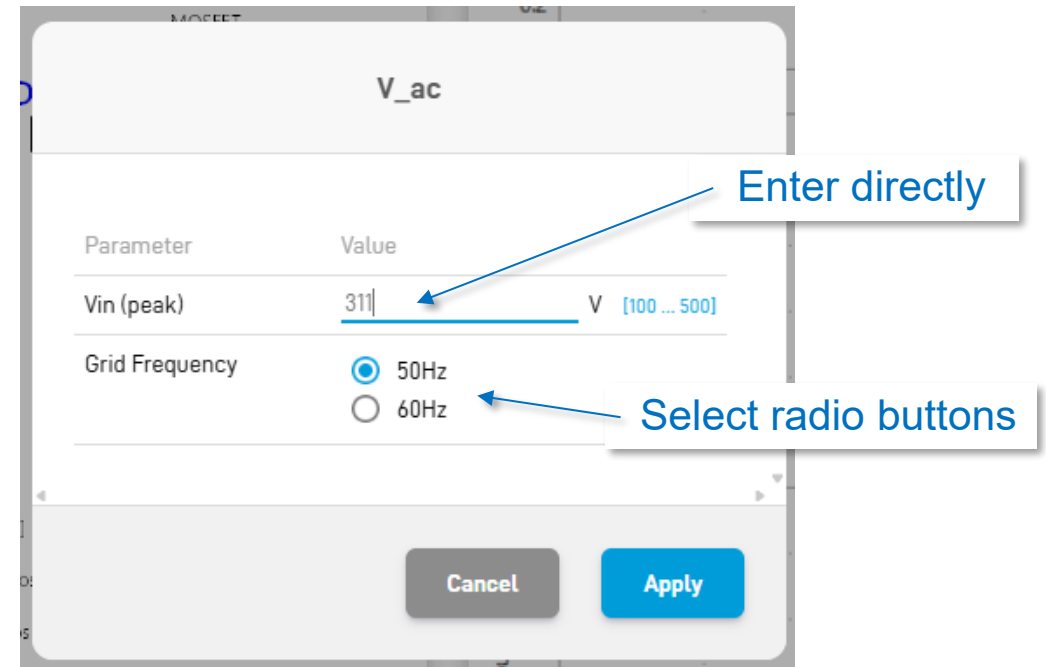


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- Symbols whose parameters can be changed are colored light-blue in the circuit diagram.
- Over your mouse cursor to the symbol that you want to change the parameter and the symbol color is turned to blue (e.g. "V_ac" symbol in the below).
- Click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

Device Conditions

General Conditions

Parameter	Value
Test_time	1 sec
Switching Frequency	<u>20000</u> Hz [10000 ... 100000]

Device Conditions

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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