

# Quick Start Guide

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TDTP4000W066C\_0v2

For evaluation purposes only

Design files and more at  
[transphormusa.com/en/evaluation-kit/  
tdtp4000w066c-ki](http://transphormusa.com/en/evaluation-kit/tdtp4000w066c-ki)

TDTP4000W066C\_0v2

Evaluation Platform

4kW Digital Bridgeless Totem-Pole PFC

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Highest Performance, Highest Reliability GaN

# Equipment Needed

- ➔ The TDTP4000W066C\_0v2 board
- ➔ Microchip DSPIC33CK256MP506 (MA330048)
- ➔ High-voltage AC power supply for input
- ➔ 12V<sub>DC</sub> auxiliary power adapter (included)
- ➔ Electronic/Resistive load
  - Power range: 0W to 4500W



## Cautions and Warnings



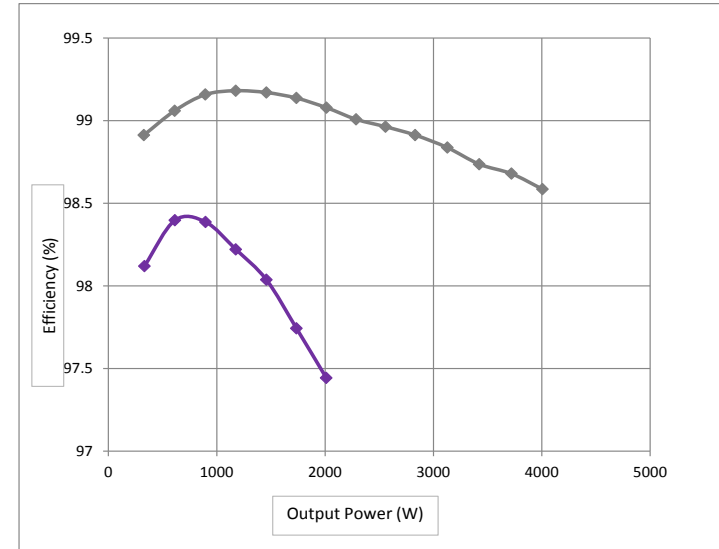
This evaluation board is intended to demonstrate GaN FET technology and is for demonstration purposes only and no guarantees are made for standards compliance.

There are areas of this evaluation board that have exposed access to hazardous high voltage levels. Exercise caution to avoid contact with those voltages. Also note that the evaluation board may retain high voltage temporarily after input power has been removed. Exercise caution when handling.

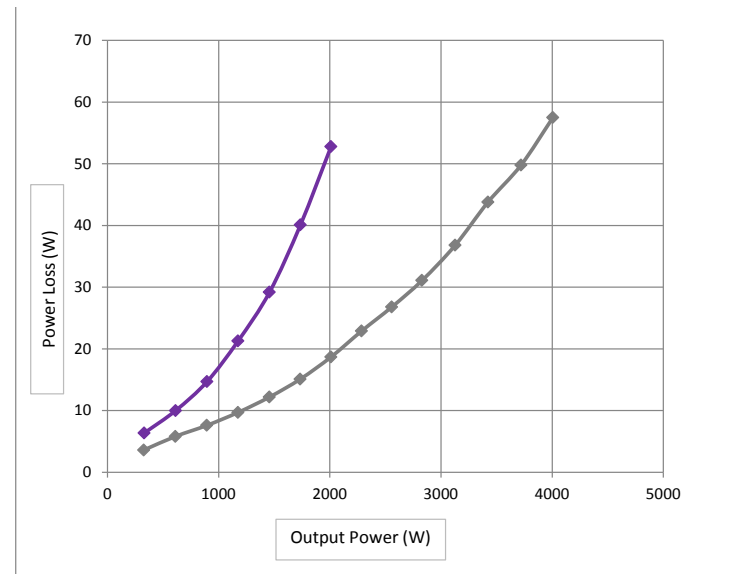
When testing converters on an evaluation board, ensure adequate cooling. Apply cooling air with a fan blowing across the converter or across a heatsink attached to the converter. Monitor the converter temperature to ensure it does not exceed the maximum rated per the datasheet specification.

See page 5 for operating guidelines.

# Typical Performance Curves



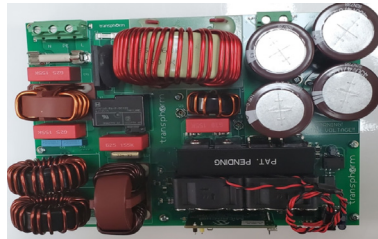
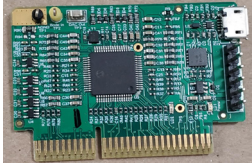
high line 230Vac, 50Hz  
low line 120Vac, 60Hz



high line 230Vac, 50Hz  
low line 120Vac, 60Hz

## Step 2: Power-up the Board

- ➔ Insert the MicroChip Plug-In-Module (PIM) to the Conn1 slot.
- ➔ Connect an electronic/resistive load to the corresponding marking (CN2). The requirements for the resistive load are:
  - At lowline, 115V<sub>AC</sub>, input: 0W and  $\leq 2200W$
  - At highline, 230V<sub>AC</sub>, input: 0W and  $\leq 4400W$
- ➔ Connect the 12V<sub>DC</sub> auxiliary supply (included) to the evaluation board
- ➔ Verify that both fans attached to the heatsink are running
- ➔ With high-voltage power off, connect the high-voltage AC power input to the corresponding marking (CN1) on the PCB; N and L (PE: potential ground)
- ➔ Turn on the AC power input (85V<sub>AC</sub> to 265V<sub>AC</sub>, 50Hz to 60Hz); minimum power load for turn-on sequence is 350W
- ➔ Monitor CN2 output voltage with V<sub>DC</sub> meter to verify that 385V  $\pm$  5V is generated
- ➔ Load can be increased when AC supply is on and board is functional



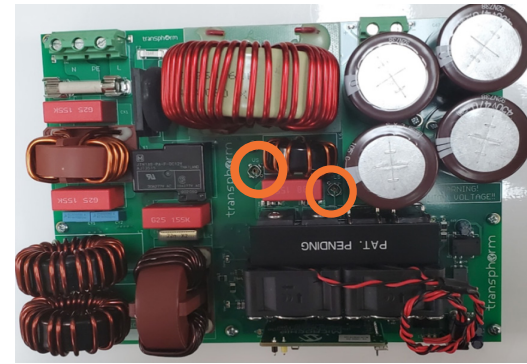
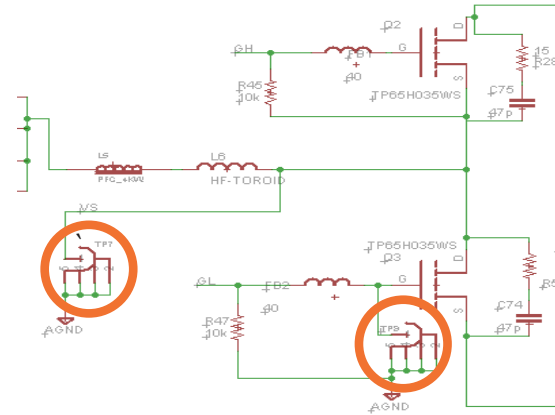
## Step 3: Power-down the Board

- ➔ Reduce load to reflect  $< 2000W$
- ➔ Switch off the high-voltage AC power input.
- ➔ Power off the Auxiliary Supply
- ➔ Verify Input and Output voltage = 0 with multi-meter / power analyzer.

Note:  
See page 5 for important operating guidelines

## Probing

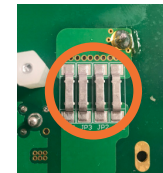
There are two voltage probing sockets to measure V<sub>GS</sub> and V<sub>DS</sub> of the GaN FET shown below.



By removing the jumpers and using a short wire to clamp the current probe, the PFC inductor can also be measured.



Passive voltage probe



Remove jumpers and add a cable for inductor current measurement

# Important Operating Guidelines

The TDTP4000W066C is for evaluation purposes only and is not intended to be a finished product and does not include all protection features found in commercial power supplies. Additional warnings to keep in mind:

- ➔ An isolated AC source should be used as input. An isolated lab bench-grade power supply or the included AUX DC supply should also be used for the 12V DC power supply. Float the oscilloscope by using an isolated oscilloscope or by disabling the PE (Protective Earth) pin in the power plug. Float the current probe power supply (if any) by disabling the PE pin in the power plug.
- ➔ Use a resistive load only. The totem-pole PFC kit can work at zero load with burst mode and the output voltage will be swinging between 375V and 385V during burst mode.
- ➔ The evaluation board is not fully-tested at large load steps. DO NOT apply a very large step in the load (>1500W) when it is running.
- ➔ DO NOT manually probe the waveforms when the board is running. Set up probing before powering up the demo board.
- ➔ The auxiliary  $V_{DC}$  supply must be 12V. The evaluation board will not work under 10V or over 15V  $V_{DC}$ , for example.
- ➔ DO NOT touch any part of the evaluation board when it is running.
- ➔ When plugging the control card into the socket, make sure the control card is fully pushed down.
- ➔ If the evaluation circuit goes into protection mode it will work as a diode bridge by shutting down all PWM functions. Recycle the bias power supply to reset the DSP and exit protection mode.
- ➔ DO NOT use a passive probe to measure control circuit signals and power circuit signals at the same time. GND1 and AGND are not the same ground.
- ➔ To get clean  $V_{GS}$  of the low side GaN FET, it is not recommended to measure the  $V_{DS}$  at the same time.
- ➔ It is not recommended to use a passive voltage probe for  $V_{DS}$  and  $V_{GS}$  measurements while simultaneously using a differential voltage probe for  $V_{IN}$  measurements, unless the differential probe has very good  $dv/dt$  immunity.

# Step 1: Connect the Board

