

PFC Evaluation Board TDPS500E2A2 with Transphorm GaN HEMT

Introduction:

To evaluate the performance of Transphorm GaN HEMTs, a PFC evaluation board TDPS500E2A2 has been made utilizing Transphorm products TPH3006PS (600 V HEMT, 0.15 ohm HEMT).

The PFC evaluation board design is based on the NCP1654 PFC controller and its reference design, running CCM mode at 140 kHz. Input voltage is 100 VAC-240 VAC, and the output power is up to 500 W at low line input (115 VAC), and 1000 W at high line (230 VAC). The schematics and BOM of the PFC board are shown below. (Fig.1, Table 1)

Caution: Please read the last page carefully and follow the instructions before testing the TDPS500E2A2 board

Test methods: GaN devices switch very fast, up to 200 V/ns. The board layout is critical to minimize parasitic inductance and capacitance which requires care when attempting to measure switching waveforms since any additional admittance will change the circuit performance.

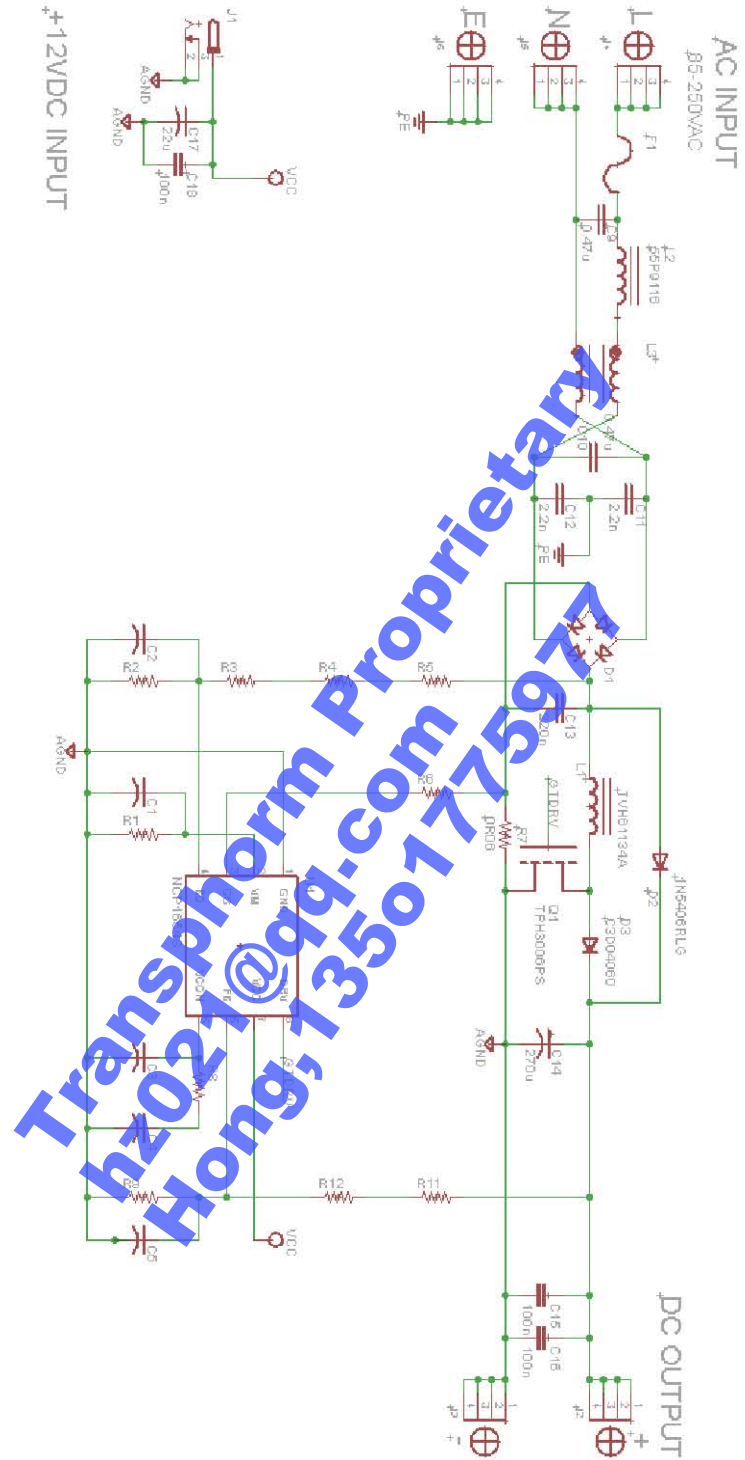


Fig.1 PFC Evaluation Board Schematics

The Transphorm GaN HEMT cuts power losses by enabling fast switching and significantly reducing switching losses. As shown below in Fig.3 and Fig.4, the switching waveforms show that the GaN device switches at >50 V/ns (turn-on) with minimum undershoot, and it has no overshoot during turn-off. This is due to the device's low output capacitance and a layout that minimizes trace inductance.

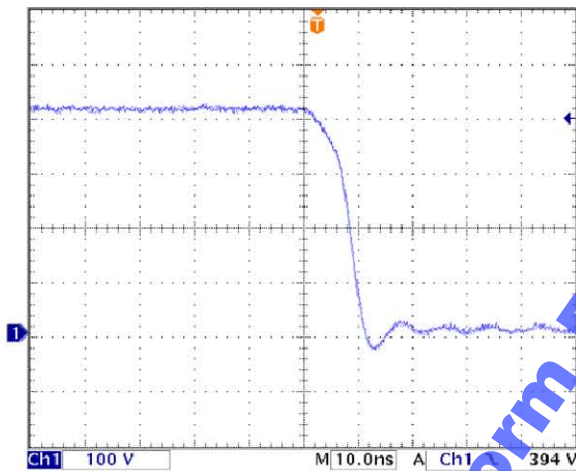


Fig.3 Drain Voltage of GaN device during Turn-on



Fig.4 Drain Voltage of GaN device during Turn-off

Such low switching loss has enabled highly efficient operation and the efficiency charts are shown below as Fig.5 and Fig.6. Thanks to the lower switching loss of GaN HEMT, the PFC board's efficiency is high under 140 kHz PWM, and the curves are relatively 'flat' under both 115 Vac or 230 Vac input, showing a much smaller efficiency drop at light load comparing to PFC boards with traditional Si MOSFET.

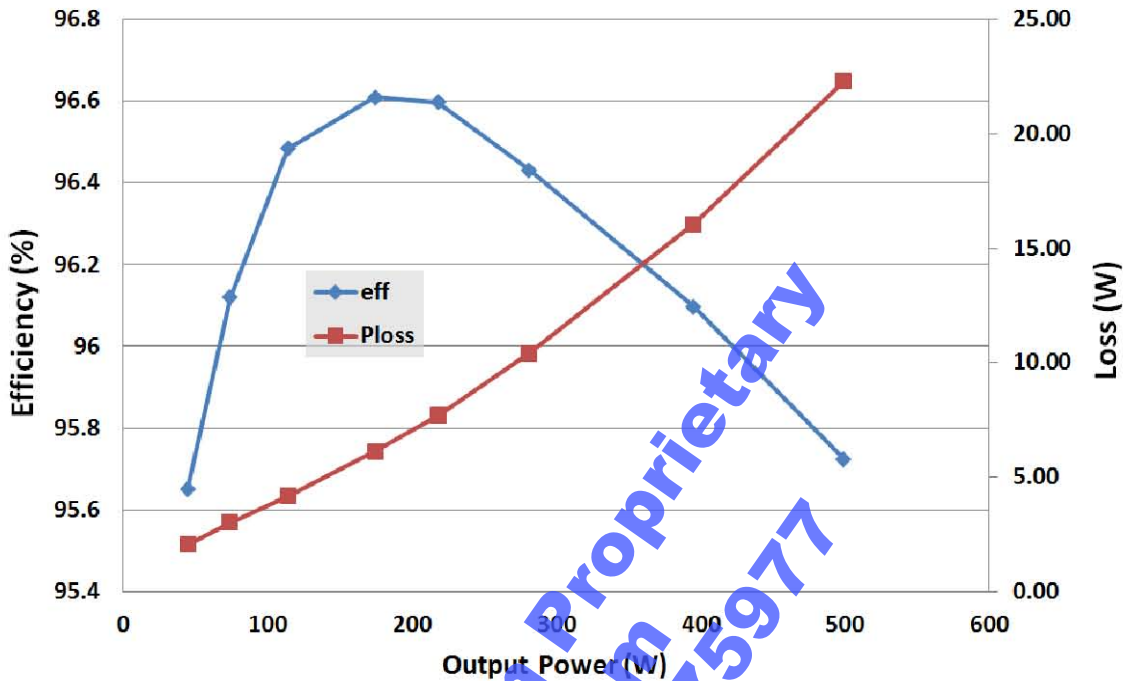


Fig.5 PFC Performance at 115 Vac input, 140 kHz PWM

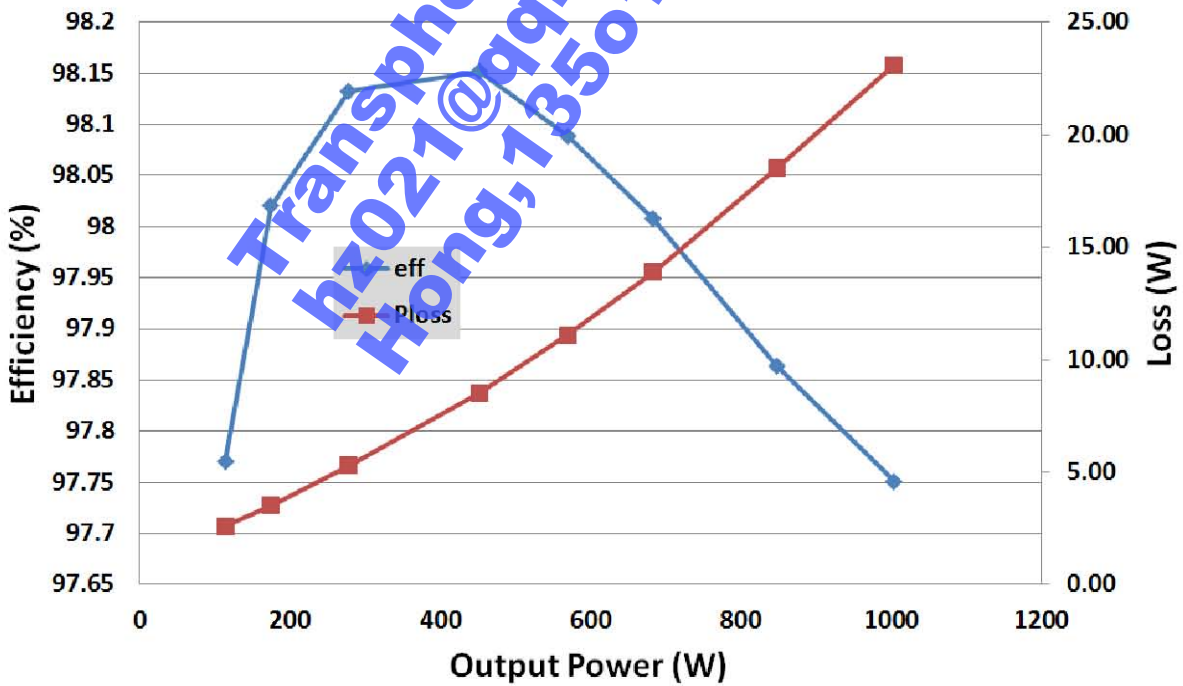


Fig.6 PFC Performance with 230 Vac input, 140 kHz PWM