

30 W GaN High-Voltage Auxiliary Power Supply for Smart Utility Meters

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1 Introduction

GPI-HVACDC-QR-EVB is a highly efficient (>90%) and primary-side regulated (PSR) auxiliary power supply. The design provides a stable 6-12 V output voltage and 30 W output power over a wide input range from 200 VAC to 500 VAC, which can be used to power various high-voltage utility meters with three-phase input at very low power loss.

The board employs the Onsemi NCV1362 quasi-resonant peak current PSR flyback controller, the Onsemi NCP4306 synchronous rectification controller, the Würth Elektronik PQ26/20 transformer and the GaNPower GPIHV10DK 1200V GaN HEMT (the latest generation of devices from GaNPower).

Thanks to the very low on state resistance (100 mΩ) and ultra-low gate charge (4 nC) value of the GaN HEMT, the switching losses are significantly reduced, and the board exhibits a superior efficiency and power factor (>90% and >0.75 at full load with 380VAC input).

2 System Overview

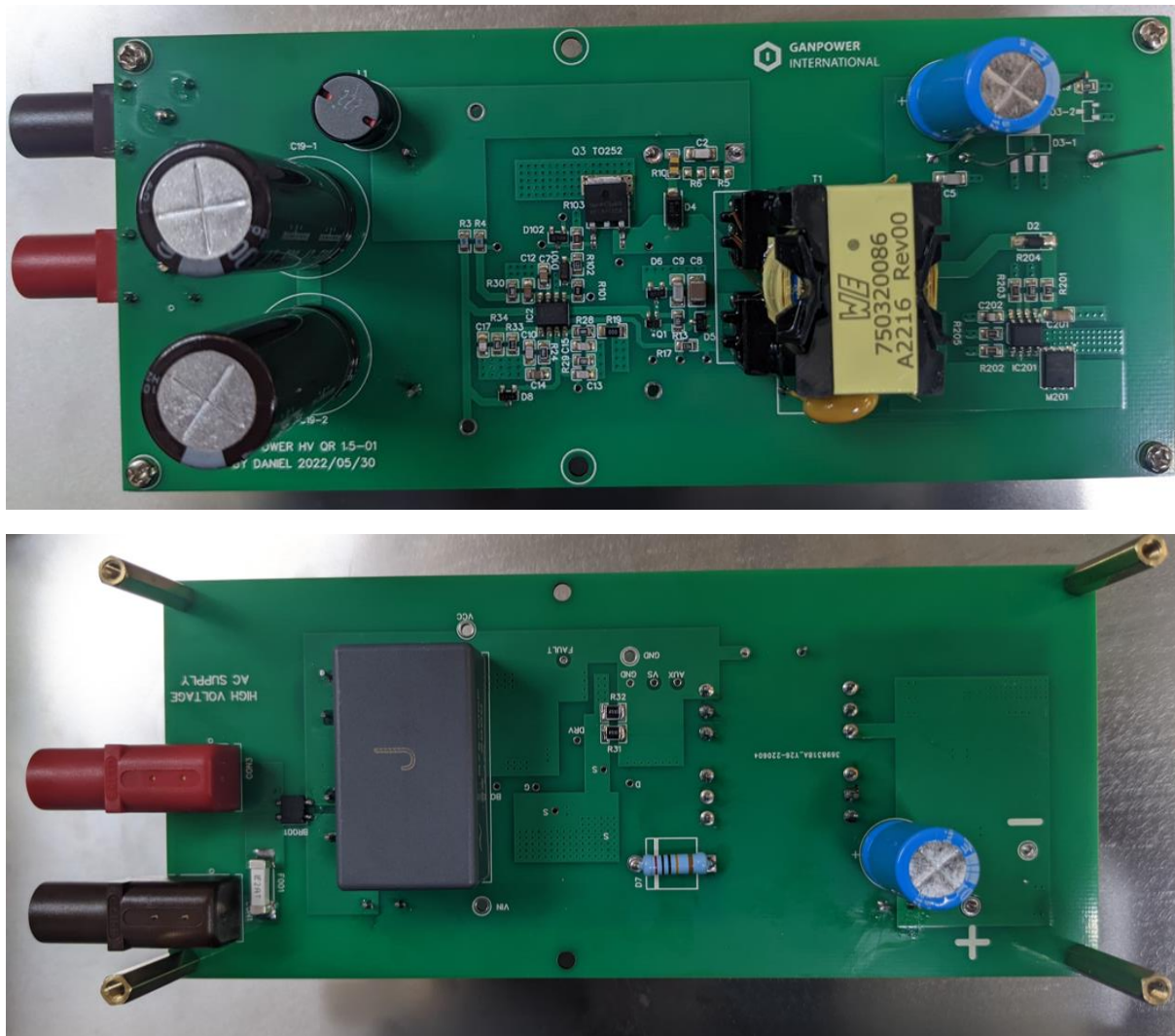


Figure 2.1 Evaluation Board

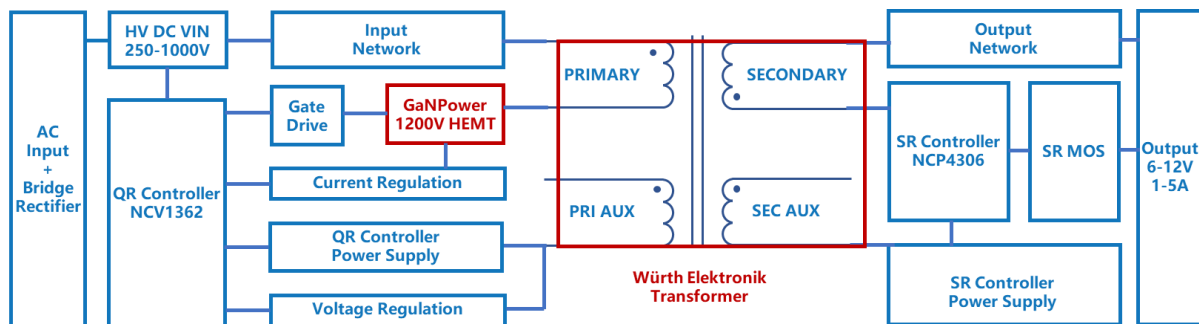


Figure 2.2 Block Diagram

3 Specification

Parameters	Values
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Input and Output

Input Voltage	200-500 VAC
Input Current	34-160 mA
Output Voltage	6-12 V
Output Current	1-5 A
Output Power	30-40 W
Efficiency	>90% @ 30 W (VIN=380VAC)

Power Switch

Part Number	GPIHV10DK
Drain-Source Breakdown Voltage	1200 V
Drain-Source DC Current (Max)	10 A
Drain-Source Static On Resistance	100 mΩ
Gate Charge	4 nC
Reverse Recovery Charge	0 nC

Transformer

Dielectric insulation	4000 VAC, 1 min.
Primary Inductance	1000 μH ± 10%
Leakage inductance	12 μH typ. / 25 μH max.
Safety standard	IEC62368-1
Pollution degree	1

Application

High-voltage Utility Meters Power Supply

4 Efficiency and Power Factor Results

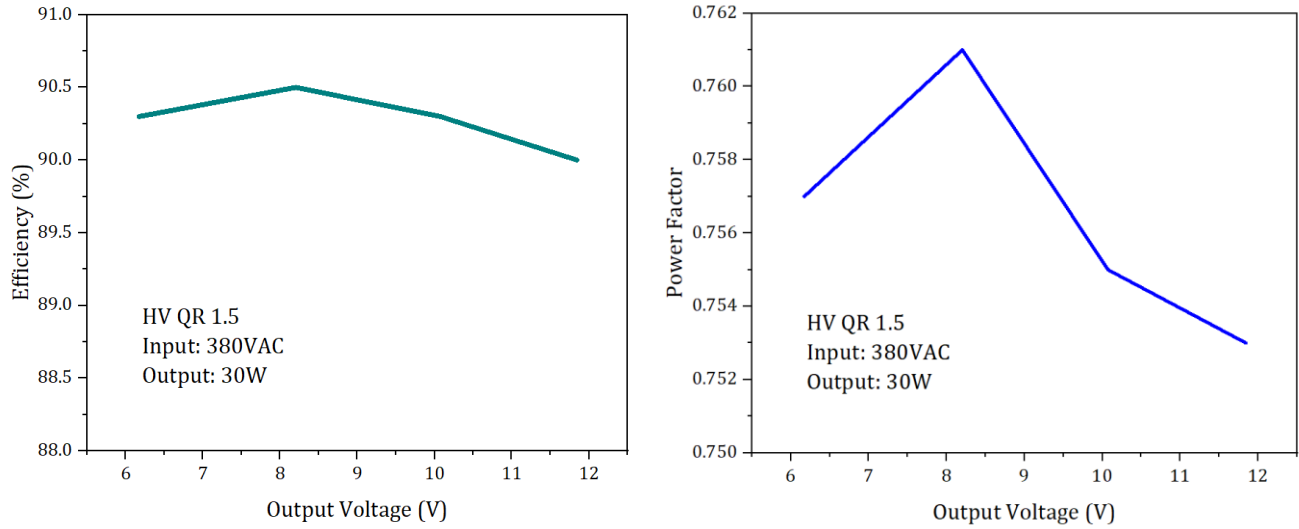


Figure 4.1 Efficiency and Power Factor Results

5 Switching Waveforms with 250/380/500VAC input at full load

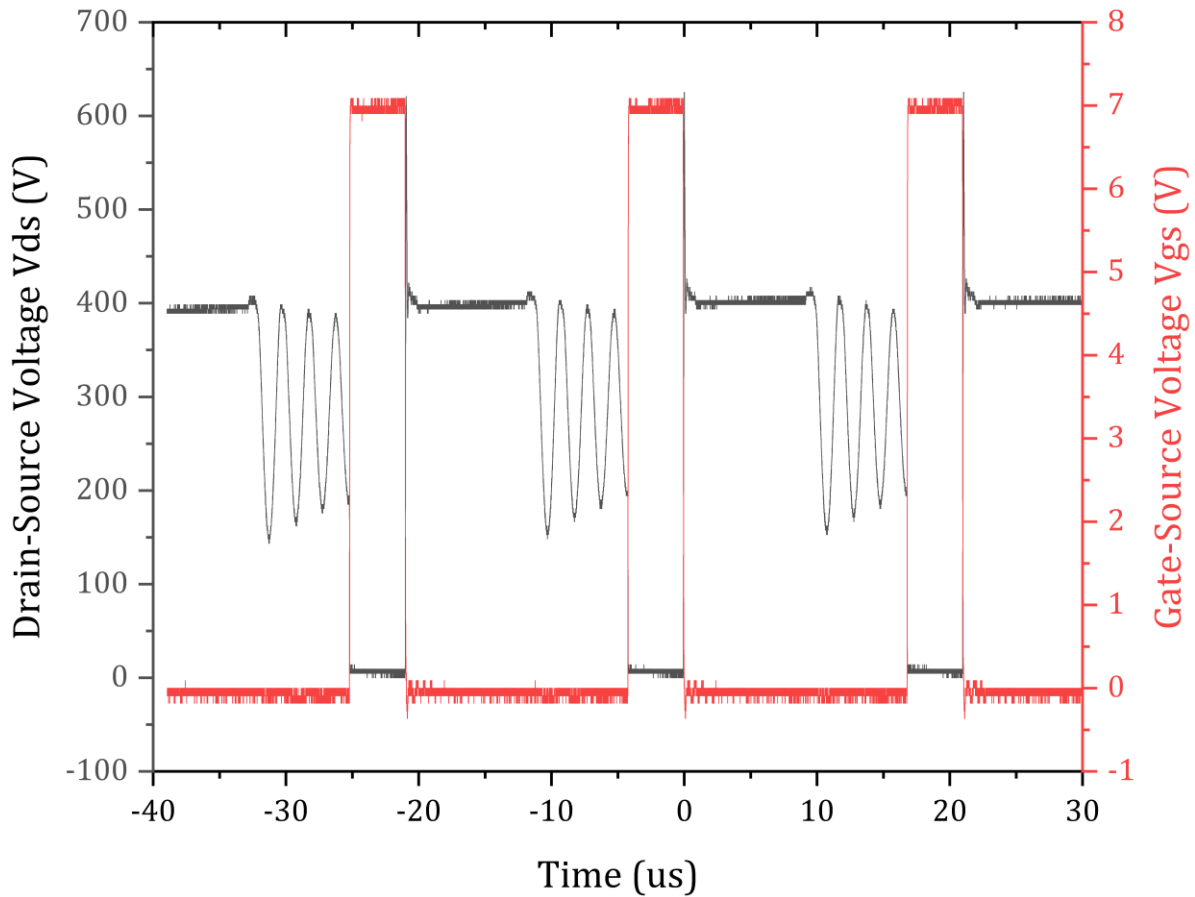


Figure 5.1 Vds and Vgs Waveforms with 250VAC input at full load

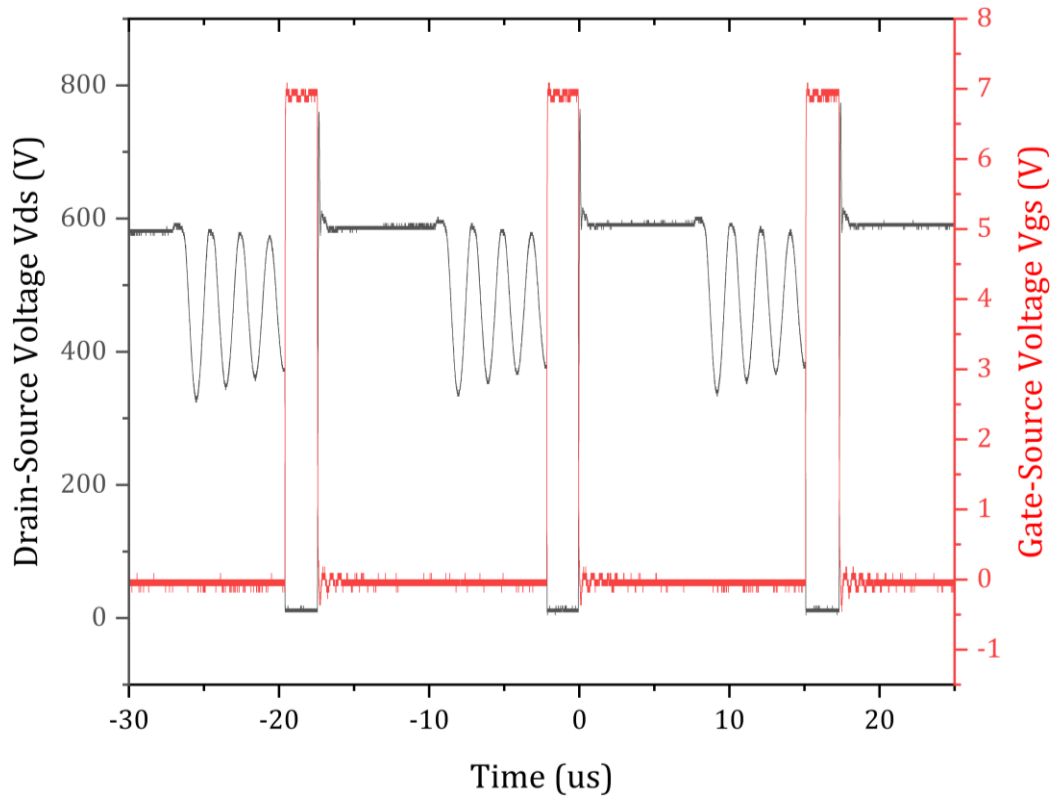


Figure 5.2 V_{ds} and V_{gs} Waveforms with 380VAC input at full load

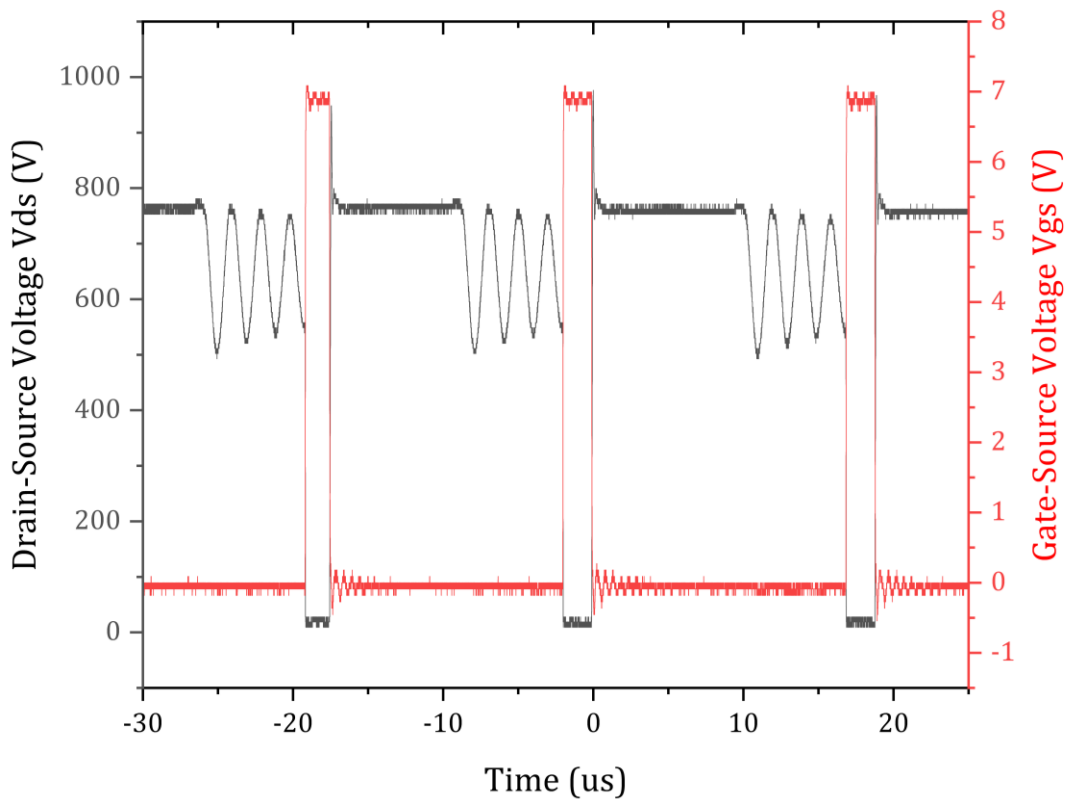


Figure 5.3 V_{ds} and V_{gs} Waveforms with 500VAC input at full load