High-Efficiency 1.2 kW Bridgeless Totem-Pole PFC using the Solantro SA4041 Digital Power Processor and GaN Systems' E-HEMTs

Application Brief September 2019

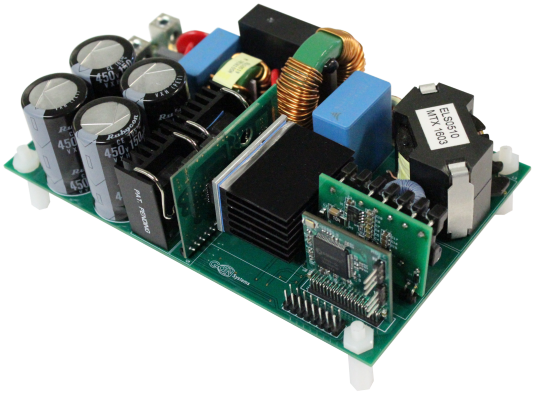
Description

This application brief highlights the performance and benefits of a 1.2 kW Bridgeless Totem Pole (BTP) PFC controlled by advanced digital control methods coupled with 650 V GaN enhancement mode HEMTs (E-HEMT). This design solution achieves 80 PLUS® Titanium standards for data centers and computing applications. It has high power density, reliable start-up, reduced heat sinking, improved cooling and low EMI. The topology is bi-directional and can be easily scaled and incorporated as a front-end of AC/DC converters for EV on-board chargers and industrial power supply applications.

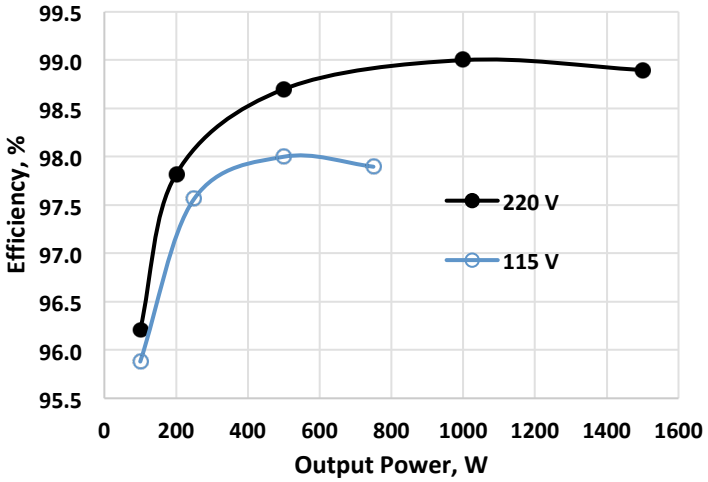
The latest Solantro® SA4041 32-bit, 50 MHz digital power processor facilitates solutions which leverage the performance benefits of GaN Systems' 650 V E-HEMT family. The SA4041 integrates high-speed analog peripherals, digital accelerators, event driven timers, and digital processing. Industrial, automotive, and renewable energy applications can benefit from the enhanced performance and reduced component count the SA4041-based solutions offer.

GaN Systems' GS66508B 650 V E-HEMTs are implemented with the patented Island Technology® cell layout for reduction of the device size and cost, while delivering substantially higher current and better performance than other GaN devices. GaN*PX*® packaging enables low inductance and thermal resistance in a small package. The GS66508B is a bottom-side cooled transistor that is easy to drive. It has exceptionally low total gate charge, Q_G, and output capacitance, C_{oss}, resulting in low switching losses and therefore providing very high efficiency.

Visit www.gansystems.com for further information on GaN E-HEMT devices for this application.
Visit www.solantro.com for further information on SA4041 Digital Power Processor IC solutions.



1.2 kW High Power Density Totem-Pole PFC Evaluation Board



Efficiency vs Output Power

Solantro's SA4041 Digital Power Processor with GaN Systems' 650 V E-HEMTs

Solantro's SA4041 Digital Power Processor with GaN Systems' 650 V E-HEMTs

Specifications

- Universal AC line input voltage (85 V- 264 V)
- 400 V DC regulated bus output voltage
- 1.2 kW continuous output power
- Full load efficiency > (99%), PF > 0.99
- Low THD (< 2.5%)
- Variable frequency control

Solution Overview: SA4041 Digital Power Processor

- 32-bit RISC CPU with 64 KB RAM and 256 KB internal flash memory
- A highly integrated mixed-signal IC with the industry's most complete set of analog and digital power peripherals. Enables designs with low parts count, high power density and low eBOM cost.
- Patented digital hardware accelerators eliminate CPU burden associated with high-frequency switching control of GaN devices and increase available CPU processing bandwidth for auxiliary system and housekeeping functions.
- Gate control with cross-conduction protection
- High-performance digital PLL for reliable grid synchronization and start-up
- Variable frequency control minimizes EMI/RFI vs competitive fixed frequency control ICs
- Optimizes efficiency at all power levels by using different control modes: burst, continuous-conduction and transition
- Communication via SPI and UART ports

GS66508B 650V E-HEMTs

- Easy gate drive requirements (0 V- 6 V)
- Transient tolerant gate drive (-20 V / +10 V)
- Very high switching frequency (> 10 MHz)
- Fast and controllable fall and rise times
- Reverse current capability
- Zero reverse recovery loss
- GaN*PX*® packaging enables low inductance & thermal resistance in high power density applications.

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