Development Board EPC9511 Rev. 1.0 Quick Start Guide

EPC2107

10 W Multi-Mode Wireless Power Amplifier Board

EFFICIENT POWER CONVERSION

DESCRIPTION

The EPC9511 is a high efficiency, power demonstration amplifier capable of operating to multiple wireless power standards. It can operate to the Qi standard of the Wireless Power Consortium (WPC), the Power Matters Alliance (PMA) standard (now merged with AirFuel™ Alliance) and AirFuel (formerly A4WP) wireless power standards. In AirFuel resonant mode, hence referred to as AirFuel mode, the EPC9511 system operates at 6.78 MHz with the amplifier circuit configured for ZVS operation. In this mode, the system can deliver up to 10 W of power into the source coil. In Qi/PMA inductive mode, the system operates at 165 kHz with the amplifier circuit configured for hard-switching operation and can deliver up to 5 W of load power into the device. An external oscillator can be used to operate the board to any desired frequency. The purpose of the EPC9511 is to simplify the evaluation process of both resonant and inductive wireless power technologies using eGaN® FETs and eGaN® ICs.

The amplifier board features various enhancement-mode GaN devices which are:

- The 100 V rated EPC2107 half-bridge eGaN® IC with integrated synchronous bootstrap FET used in the main wireless power amplifier.
- The 100 V rated EPC2036 eGaN FET used in the ZVS disconnect switch circuit and the main device of the SEPIC converter pre-regulator.
- The 100 V rated EPC2038 eGaN FET used in the controller circuit for changing set points based on operating mode.

The amplifier is configured for single ended operation and includes the gate driver(s), oscillators, and feedback controller for the pre-regulator, which ensures operation for wireless power control based on the AirFuel standard. This configuration allows for testing compliant to the AirFuel Class 2 standard over a load range as high as ±35j Ω. The pre-regulator features the 100 V rated 65 mΩ EPC2036 as the main switching device for a SEPIC converter.

** Maximum current depends on die temperature – actual maximum current will be subject to switching frequency, bus voltage and thermals.*

ZVS Timing Adjustment (AirFuel Mode ONLY)

Setting the correct time to establish ZVS transitions is critical to achieving high efficiency with the EPC9511 amplifier when operating at high frequency. This can be done by selecting the values for R71 and R72 or P71 and P72 respectively. This procedure is best performed using a potentiometer installed at the appropriate locations (P71 and P72) that is used to determine the fixed resistor values. The timing MUST initially be set WITHOUT the source coil connected to the amplifier. The timing diagrams are given in figure 8 and should be referenced when following this procedure. Only perform these steps if changes have been made to the board as it is shipped preset. The steps are:

1. With power off, remove the jumper in JP1 and install it into JP50 to place the EPC9511 amplifier into Bypass mode. Connect the main input power supply (+) to JP1 (bottom pin – for bypass mode) with ground connected to J1 ground (-) connection.
2. With power off, connect the control input power supply bus (19 V) to Vin+ connector (J1). Note the polarity of the supply connector.
3. Connect a LOW capacitance oscilloscope probe to the probe-hole of the half-bridge to be set and lean against the ground post as shown in figure 7.
4. Turn on the control supply after ensuring that the supply is approximately 19 V with a 2 A current limit.
5. Turn on the main supply voltage to the required predominant operating value (such as 24 V but NEVER exceed the absolute maximum voltage of 80 V).
6. While observing the oscilloscope, adjust the applicable

b. Operation bypassing the pre-regulator

In this mode, the pre-regulator is bypassed and the main power is connected directly to the amplifier. This allows the amplifier to be operated using an external regulator. NOTE: In this mode there is no protection for ensuring the correct operating conditions for the eGaN devices.

1. Make sure the entire system is fully assembled prior to making electrical connections and make sure jumper JP1 has been removed and installed in JP50 to disable the pre-regulator and place the EPC9511 in bypass mode. Also make sure a source coil is attached to the amplifier and that device board is connected to a load.
2. With power off, connect the main input power supply bus to the bottom pin of JP1 and the ground to the ground connection of J1 as shown in figure 4.
3. With power off, connect the control input power supply bus to $+V_{IN}$ (J1). Note the polarity of the supply connector. This is used to power the gate drivers and logic circuits.
4. Make sure all instrumentation is connected to the system.
5. Turn on the control supply – make sure the supply is in the 19 V range.
6. Turn on the main supply voltage to the required value (it is recommended to start at 0 V and do not exceed the absolute maximum voltage of 80 V or the current rating of the main EPC2107 ICs).
7. Once operation has been confirmed, adjust the main supply

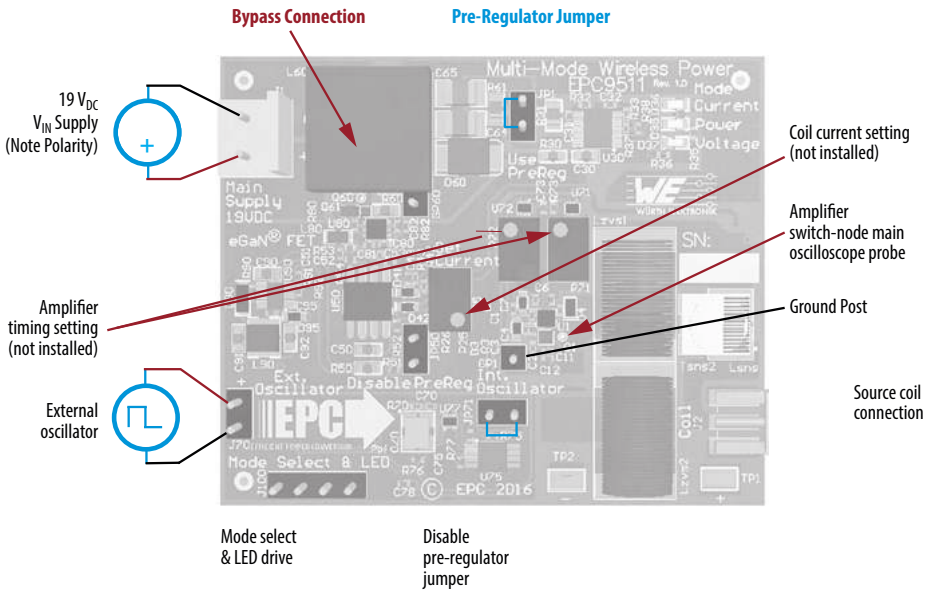


Figure 4: Proper connection and measurement setup for the EPC9511 ampli er board.

Figure 5: Proper connection setup for operating mode selection using a switch and LEDs.

Figure 6: Proper connection setup for operating mode selection using jumpers.

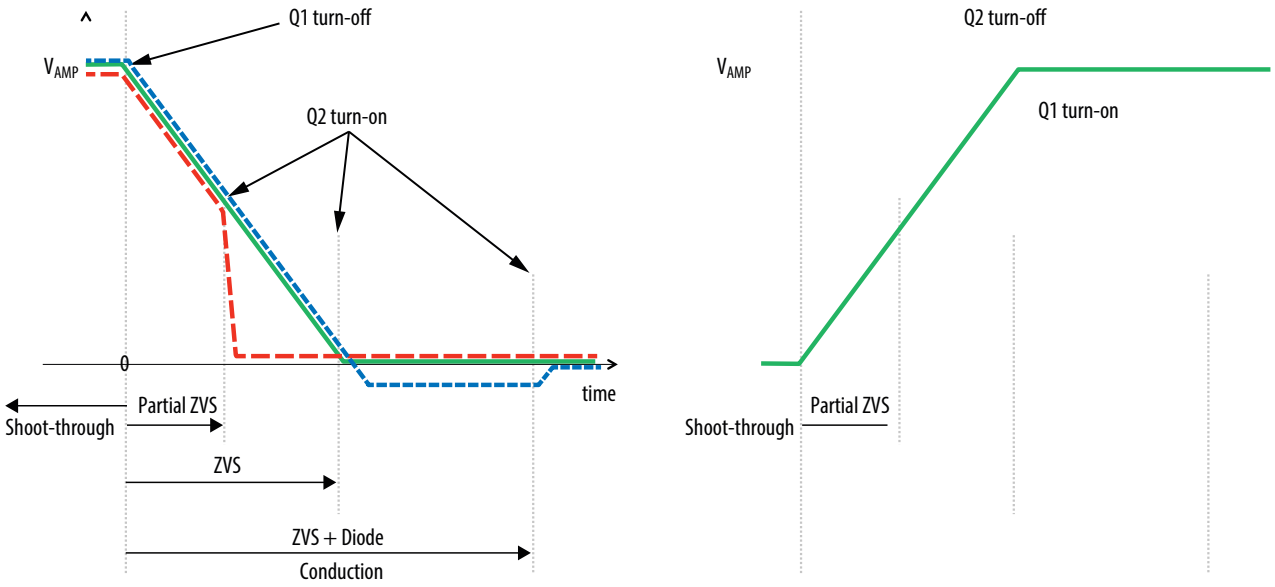
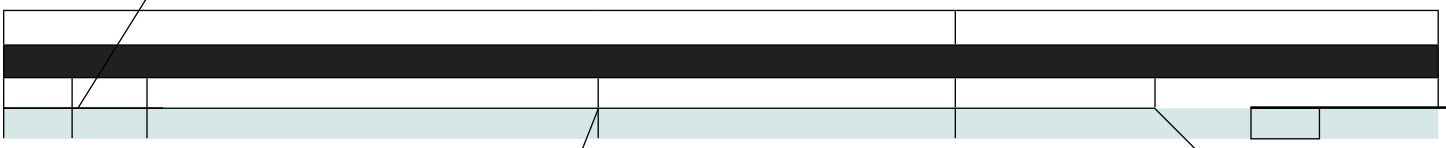


Figure 8: ZVS timing diagrams



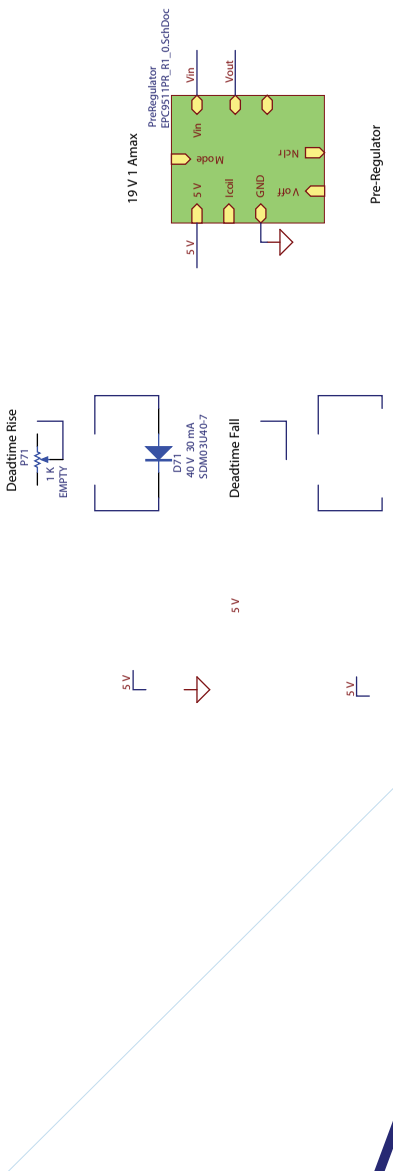


Figure 9: EPC9511 - ZVSclass-D ampli er schematic

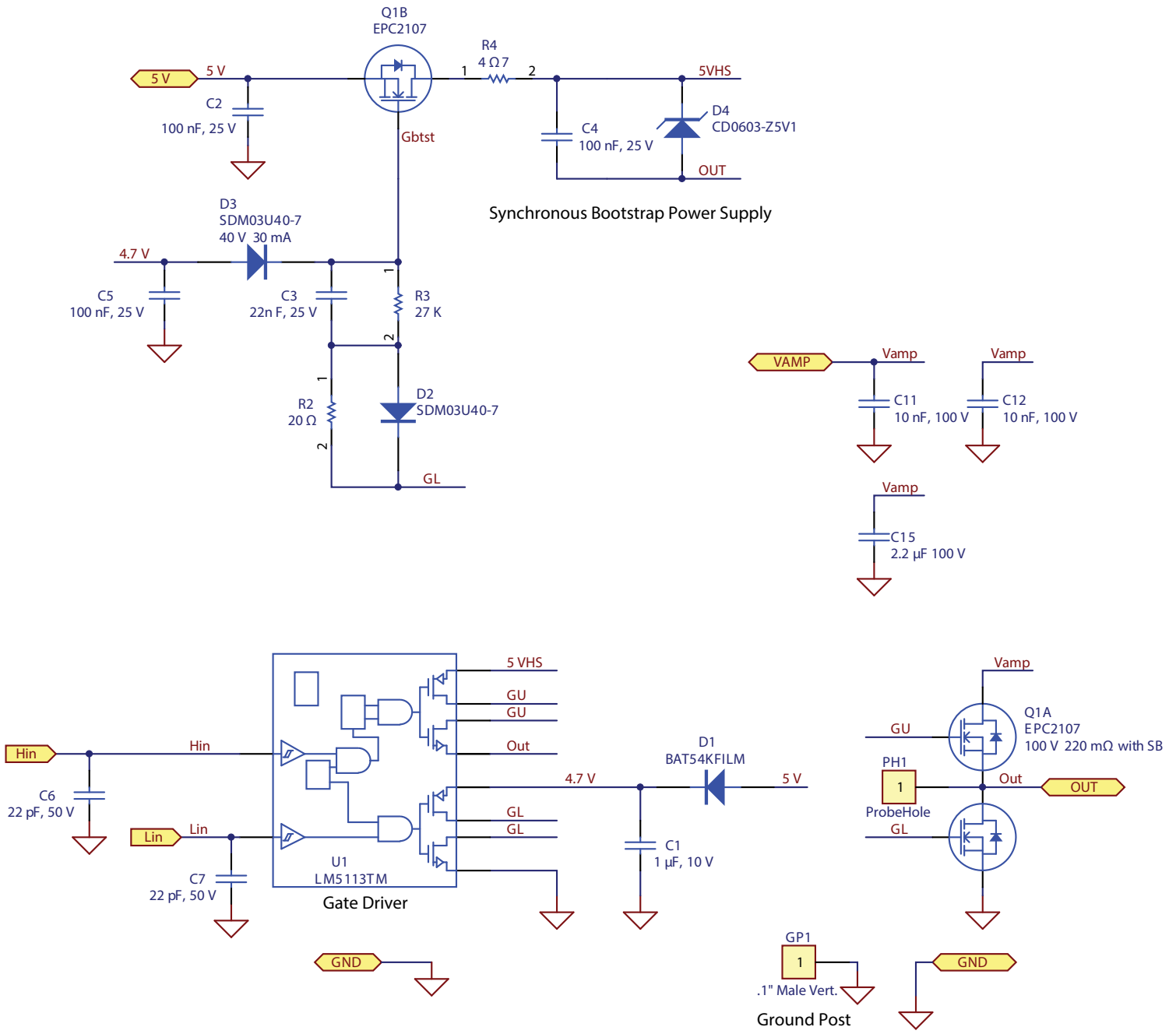


Figure 10: EPC9511 - Gate driver and power devices schematic

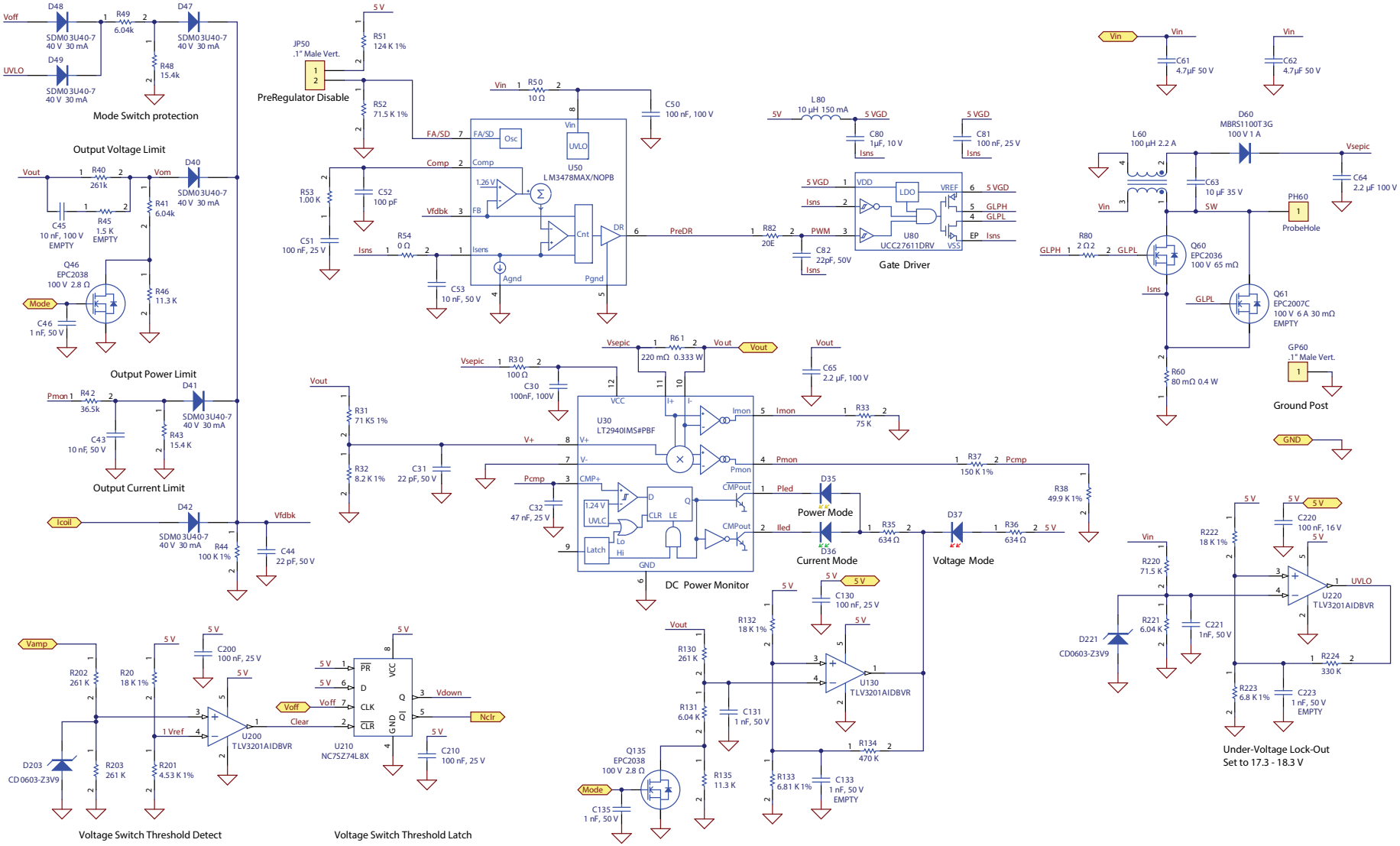


Figure 11: EPC9511 - Pre-regulator schematic

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The EPC9511 board is intended for product evaluation purposes only and is not intended for commercial use. Replace components on the Evaluation Board only with those parts shown on the parts list (or Bill of Materials) in the Quick Start Guide. Contact an authorized EPC representative with any questions.

This board is intended to be used by certified professionals, in a lab environment, following proper safety procedures. Use at your own risk.

As an evaluation tool, this board is not designed for compliance with the European Union directive on electromagnetic compatibility or any other such directives or regulations. As board builds are at times subject to product availability, it is possible that boards may contain components or assembly materials that are not RoHS compliant. Efficient Power Conversion Corporation (EPC) makes no guarantee that the purchased board is 100% RoHS compliant.

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