Utilizing the DRV835x Split Supply Power Topology For Optimal System Design

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Introduction

The DRV835x family of devices are highly-integrated gate drivers for three-phase brushless DC (BLDC) motor applications. Due to the wide range of system configurations and efficiency requirements, the DRV835x supports a flexible power supply architecture in order to provide different tradeoffs in power supply integration and device efficiency. This tech notes describes the different power supply configurations the DRV835x supports with their benefits and their tradeoffs.

Power Supply Input Definitions

The DRV8350 and DRV8353 have two primary power supply inputs, VM and VDRAIN. The DRV8350R and DRV8353R (integrated buck regulator) have three primary power supply inputs, VM, DRAIN, and VIN. For more information on the different device variants of the DRV835x family you can refer to the *Architecture for Brushless-DC Gate Drive Systems* application report.

- **VM** is the driver primary power supply input. Power supply for the charge pump regulator primary stage (internal half-bridge), low-side driver VGLS linear regulator, and digital DVDD linear regulator.
- **VDRAIN** is the driver secondary power supply input. Power supply for the charge pump regulator secondary stage (flying cap voltage), charge pump voltage regulation reference, and VDS overcurrent monitor voltage reference.
- **VIN** is the buck regulator power supply input.

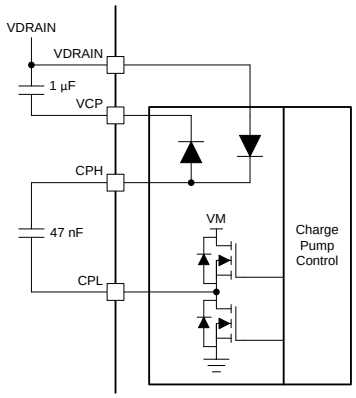

Figure 1. DRV835x Charge Pump Architecture

Single Power Supply Configuration

In the single power supply configuration, all three power inputs (VM, VDRAIN, and VIN) for the DRV835x are connected to a main external power supply. This power supply is also the used directly for the external MOSFET half-bridges. Depending on your system requirements, single power supply configuration provides a method to reduce system cost and size but removing an intermediate buck regulator that is typically used to generate 12-V to 15-V for the gate driver power supply. Instead, the DRV835x internally regulates down the high voltage power supply to the immediate levels. In this configuration, the high voltage buck regulator can then directly step down to the logic level voltage.

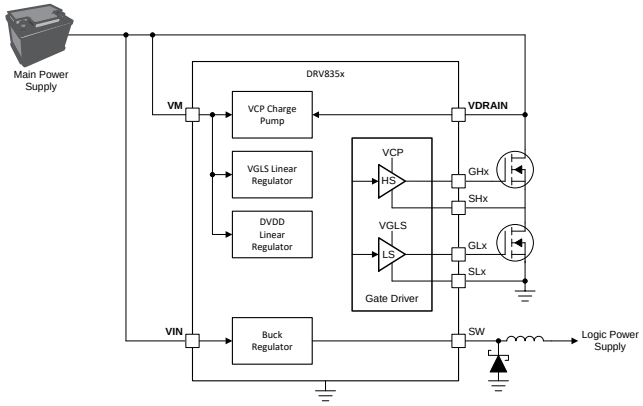

Figure 2. Single Supply Configuration

Benefit:

- Removes the need for an additional regulator in the system to generate an intermediate power supply for the gate drivers. High voltage buck regulator can step down directly to the logic level power supply.

Tradeoff:

- Increased power dissipation inside the DRV835x due to increased power dissipation in the VCP, VGLS, and DVDD regulators since the DRV835x is internally regulating the high voltage input down to the intermediate power supplies. See the *DRV835x Device Datasheet* application section for additional details on how to calculate the exact power dissipation of the driver.

Dual/Split Power Supply Configuration

In the dual/split power supply configuration, only the VDRAIN and VIN inputs are connected directly to the main external power supply. The external MOSFET half-bridges are also still connected to the main external power supply. The VM input is then connected to a lower voltage supply typically between 12-V to 15-V.

Benefit:

- Reduces the internal power dissipation of the DRV835x allowing it to operate up to higher ambient temperatures, improve its efficiency, and increase the max allowable gate drive current.

Tradeoff:

- Adds additional system cost and design complexity by requiring an intermediate power supply voltage in between the main power supply and logic power supply.

Depending on your system requirements, dual/split power supply configuration provides a method to reduce power dissipation in the DRV835x and improve the overall efficiency of the system by using a more efficient switching regulator to generate the intermediate power supply of 12-V to 15-V. In this configuration, the high voltage buck regulator can be used to create the intermediate power supply and another regulator is used to regulate the intermediate power supply down to the logic level power supply.

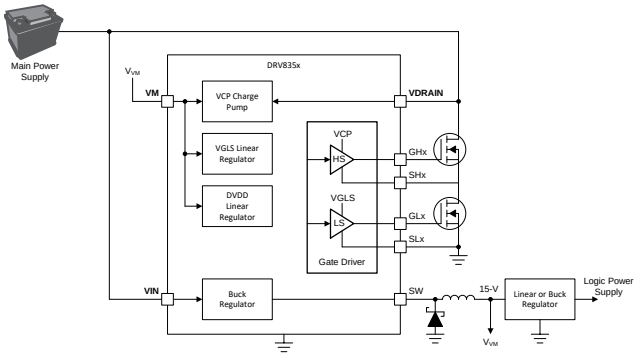

Figure 3. Dual Supply Configuration

Conclusion

With a wide input power supply range and an option for an integrated buck regulator the DRV835x provide a flexible device for a variety of different system architectures.

Related Documentation

- *Architecture for Brushless-DC Gate Drive Systems*
- *DRV835x Device Datasheet*

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