

RAA489301

3-Level Buck Controller with Pass-Through Mode

The [RAA489301](#) is a 3-level buck voltage controller that provides seamless transitions among $V_{OUT} < V_{IN}/2$, $V_{OUT} = V_{IN}/2$, and $V_{OUT} > V_{IN}/2$. The RAA489301 provides a wide range of regulated output voltage and high efficiency. It also reduces the inductor size significantly.

The advanced Renesas R3™ Technology provides high light-load efficiency, fast transient response, and seamless DCM/CCM transitions. The RAA489301 supports input sources such as batteries of various chemistries in 2S to 5S configurations, and it supports the USB PD adapter safely converting it to a regulated output voltage up to 24V. The RAA489301 can also convert a wide range of input side DC power sources to a regulated output voltage.

In addition to a 3-level buck configuration, the RAA489301 also supports pass-through mode (PTM) in both forward and reverse directions. The PTM allows high efficiency for modes in which the input and output voltage are identical. The RAA489301 has independent control loops for the input voltage, input current, output voltage, and output current so that it can be used as a pre-regulator for a CPU power supply rail system.

The RAA489301 includes system operation functions such as the isolation MOSFET control, adjustable output voltage, programmable switching frequency, and a power-good indicator. The protection functionalities include OCP, OVP, UVP, and OTP. The RAA489301 has serial communication through SMBus/I²C that allows programming of many critical parameters to deliver a customized solution. These programming parameters include, but are not limited to minimum input voltage, maximum output voltage, maximum input current limit, and maximum output current limit setting.

Features

- Single inductor 3-level buck controller
- Proprietary modulator for flying capacitor balancing and smooth mode transition
- Wide input voltage range: 4.5V to 24V
- Wide output voltage range: 3V to 24V
- Programmable switching frequency: up to 367kHz (734kHz at switching node effectively)
- EXT5V pin to generate 5V or 10V gate drive voltage through internal charge pump
- Low shutdown current: 25μA
- Pass through mode (PTM) in both directions
- Support pre-biased output with soft-start
- Input and output current monitor
- MOSFET drivers with adaptive shoot-through protection
- Complete protection: OCP, OVP, UVP, and OTP
- SMBus and I²C compatible
- 32 Ld 4x4 TQFN package

Applications

- Pre-regulator for a CPU power supply rail system
- USB PD 3.0/3.1 systems
- Robots and drones
- Security surveillance
- Medical equipment

1. Overview

1.1 Block Diagram

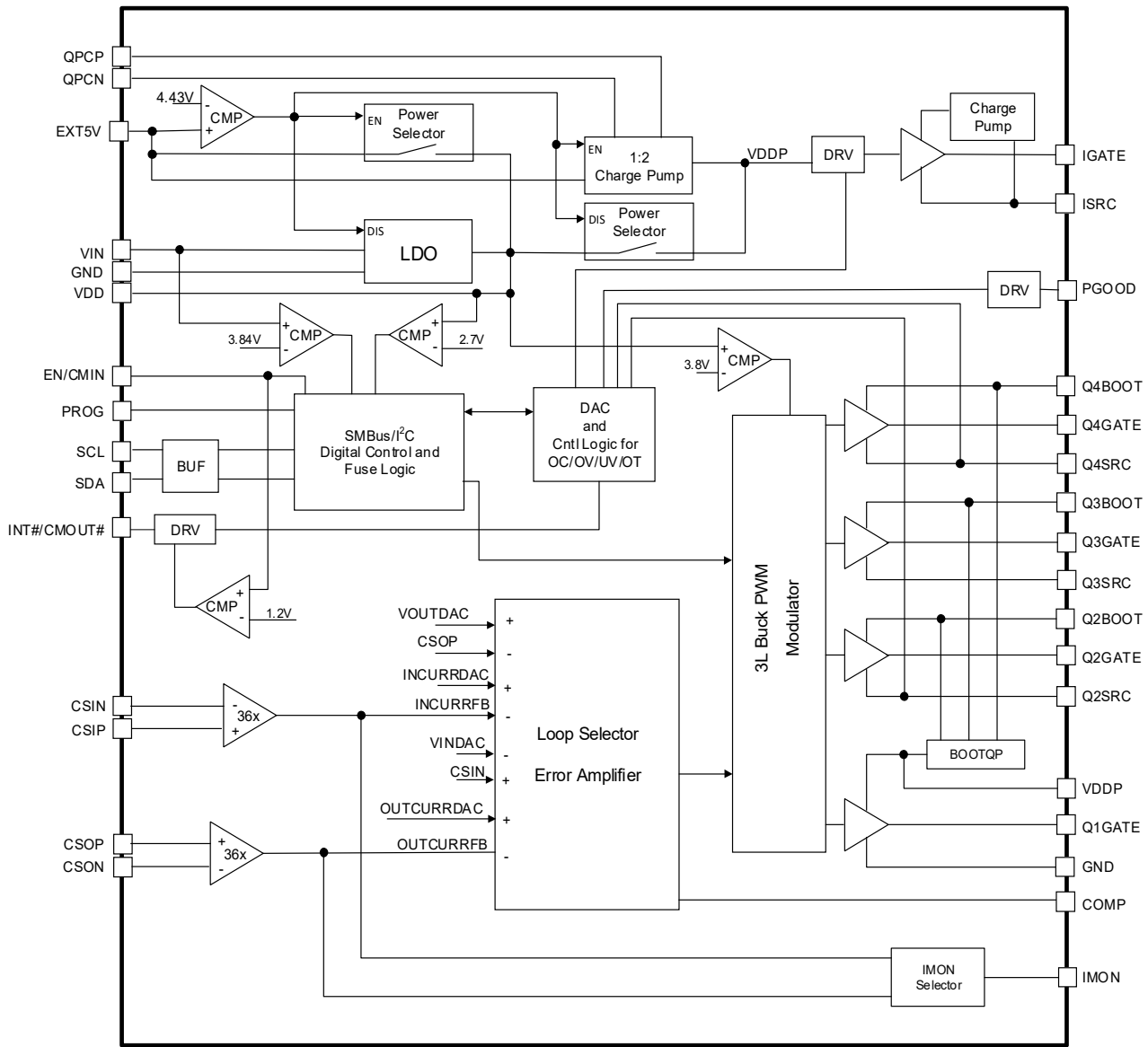


Figure 1. Block Diagram

1.2 Typical Application

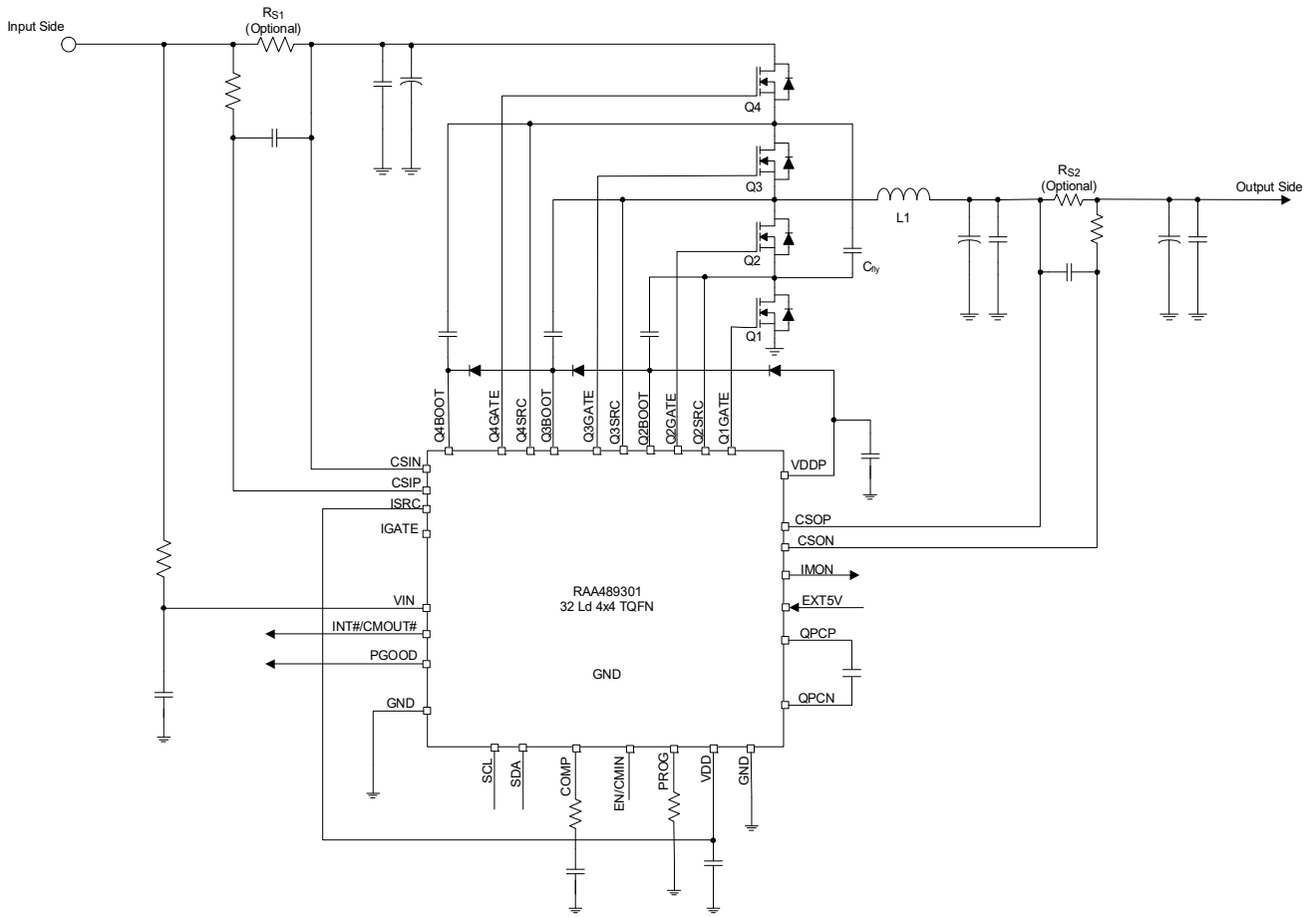


Figure 2. Typical Application Circuit

2. Revision History

Revision	Date	Description
1.00	Oct 15, 2024	Initial release.

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