Technical Article

How to Power Next-generation ADAS Camera Modules

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We've all heard the headlines lately about efforts going into developing and testing a new generation of autonomous vehicles. Developing advanced driver assistance systems (ADAS) is an important trend in the automotive industry to make driving safer and pave the way to autonomous driving. This push toward increased driver assistance and automation relies on a variety of different sensors designed into the cars of tomorrow, such as cameras, radar or LIDAR.

Camera modules, in particular, will provide critical data for the autonomous decision-making process, such as reading road signs; thus, the requirements on car vision systems are rapidly evolving to gather more information. For example, the pixel count of CMOS image sensors used in cameras is increasing, which leads to more data processing and higher power consumption. Another constraint is that the camera modules must be small, efficient and discreet – no one wants to ruin the design of a car with a camera sticking out from the bodywork. So how can you power your next-generation ADAS camera modules to support more data-gathering capability and smaller sizes?

You first have to think about whether to use a DC/DC switching regulator or a low-dropout regulator (LDO) for each of the rails in your system. LDOs are a great choice if your current requirements are low or if the rail is very sensitive to noise (such as the analog input rail of a CMOS image sensor). However, with the trend toward higher pixel counts and increased power consumption, a DC/DC switching regulator will often be a better choice to minimize power losses and temperature rise.

Then, you must decide on your power tree. You have three main options:

- **Fully integrated:** using a dedicated power-management integrated circuit (PMIC) to provide all of the camera modules' power rails. This simplifies the solution but lacks flexibility.
- **Fully discrete:** using a discrete power supply to generate each power rail. This gives you maximum flexibility but can require more design time to choose all of the different ICs and sometimes has a larger total solution size compared to a higher integrated solution.
- **Partial integration:** using a mix of single- and multichannel power supplies to simplify the design, with more flexibility than using only a PMIC.

We offer solutions for all of these options, as you can see in Figure 1-Figure 3.

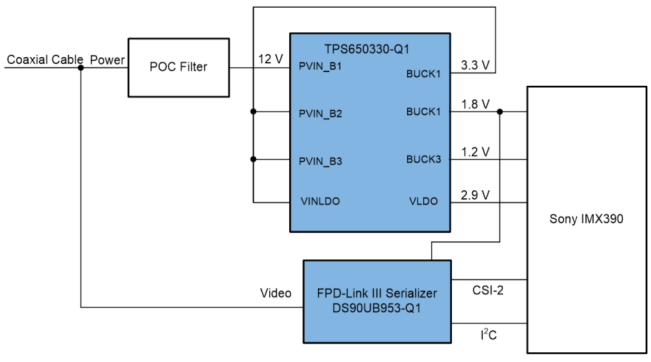

Figure 1. Example of the Highly Integrated Approach with the Automotive Camera PMIC Power Supply Reference Design with Power Over Coax Filter

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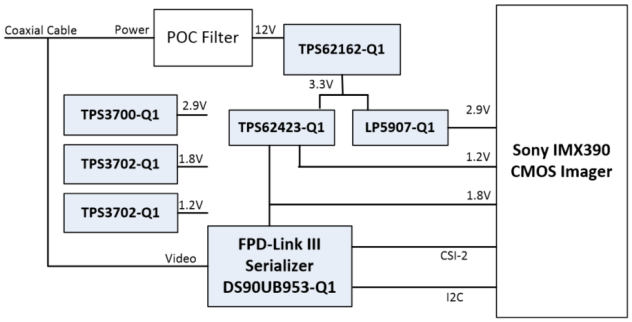

Figure 2. Example of the Discrete Approach with the Automotive 2-MP camera module reference design with MIPI CSI-2 video interface, FPD-Link III and POC

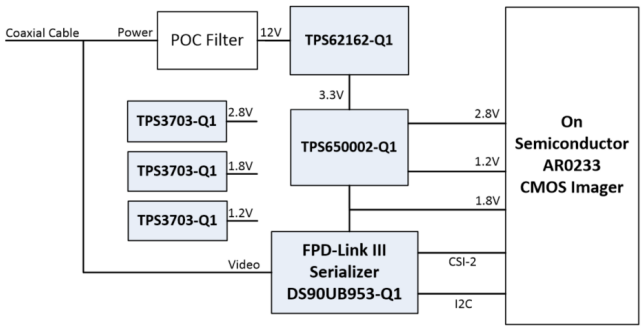

Figure 3. Example of the Partial Integration Approach with Added Precision Diagnostics for the Supply Voltage Rails

Using a dual step-down DC/DC converter for partial integration provides a simpler bill of materials than a discrete DC/DC switching regulator and offers more flexibility on the layout than a full-fledged PMIC, which is a good compromise between making your design simpler and keeping the layout flexible to best address the size constraints of camera modules.

TI is releasing two new fixed-output-voltage versions of a dual-channel step-down converter that are good choices for your automotive camera module designs. The TPS62423-Q1 and TPS62424-Q1 have a small 3mm-by-3mm package and no need for external resistor dividers.

The fixed output voltages of these new devices were chosen specifically to meet the power requirements of the latest CMOS image sensors, as you can see in Table 1.

Table 1. Matrix of Image Sensors and the Matching Power Supply

Image sensor	Rail 1	Rail 2	Power
OX01B40	1.8V	1.1V	TPS62424-Q1
OV2311, OX03A10, OV7916, AR0231AT	1.8V	1.2V	TPS62423-Q1
OV2775	1.8V	1.3V	TPS62424-Q1
OV10640, OX02A10, OV10642, OV10650, OV7261	1.8V	1.5V	TPS62423-Q1

It's an exciting time to be an engineer working on automotive electronics and ADAS, and TI is working hard to support you with the products you need to get your next camera module power-supply design rolling, no matter which power architecture you decide on.

Additional Resources

- Take a look at TI's ADAS portal.
- Try our interactive block diagram for ADAS camera modules to find products and reference designs.
- Get some tips on reducing ripple for sensitive and dynamic rails in the blog post, "Ripple reduction techniques for sensitive and dynamic rails in automotive camera modules."

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