MPS Solutions for Intelligent Driving

The four modern trends of the automotive industry are electrification, intelligence, networking, and sharing. Among these development trends, intelligence requires advanced on-board sensors, controllers, and actuators.

Highly intelligent systems tend to have more sensors. As such, the number and variety of cameras/sensors installed on cars increase daily. These include the cameras installed on the car body, 360°surround view, front view, and streaming media rearview mirror. Two common examples are the driver monitoring system (DMS) and the cabin monitoring system (CMS). The DMS uses a camera mounted on the dashboard to warn the driver if they seem to be distracted or tired. The CMS can track the temperatures in the vehicle, provide theft protection, and detect occupants within a vehicle. These features provide both safety and convenience for the end user.

An electronic control unit (ECU) typically functions as a camera's power supply by using Power over Coaxial (PoC) functionality through a long coaxial cable. Between the ECU and camera, the power supply can experience line loss, in addition to a voltage drop in the vehicle's battery voltage. To maintain a constant output voltage across changes in the input voltage, buck-boost converters are an excellent solution that provide stable and reliable power for cameras. This is especially vital for functions that provide safety features, such as the DMS.

Compared to traditional cameras, the latest DMSs and CMSs contain an infrared (IR) LED light that can track the driver as well as the passenger. MPS provides solutions for intelligent driving with buck-boost converters and infrared LED drivers, described in greater detail below.

Power Supply Solution with the MPQ8875A-POC

The MPQ8875A is a configurable, highly integrated, synchronous buck-boost converter with AEC-Q100 qualification. The device can output 12V to meet the camera's power supply requirements, which are generally between 9V and 16V for the vehicle's battery voltage. Figure 1 shows how the MPQ8875A integrates four low-impedance MOSFETs (Q1: 10mΩ, Q2: 25mΩ, Q3: 10mΩ, and Q4: 25mΩ). These MOSFETs allow the converter to regulate the output voltage (V_{OUT}) depending on whether the input voltage (V_{IN}) is above, below, or equal to V_{OUT}.

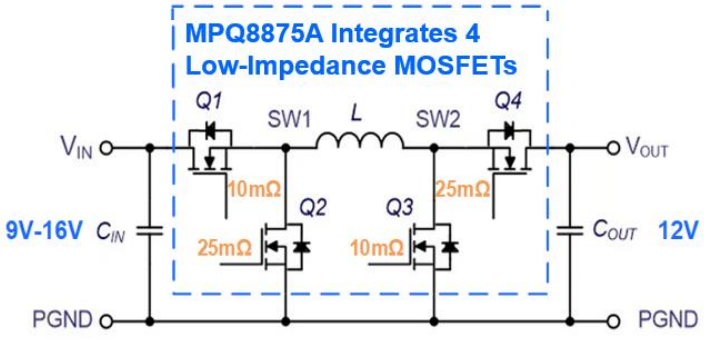

Figure 1: The MPQ8875A's Four MOSFETs

The MPQ8875A's ultra-compact QFN-34 (4mmx5mm) package reflects its ultra-high power density, output load capacity up to 5A, and superior efficiency performance. Its small size makes it a versatile part for any automotive system, and it boasts an efficiency of almost 98% (see Figure 3).

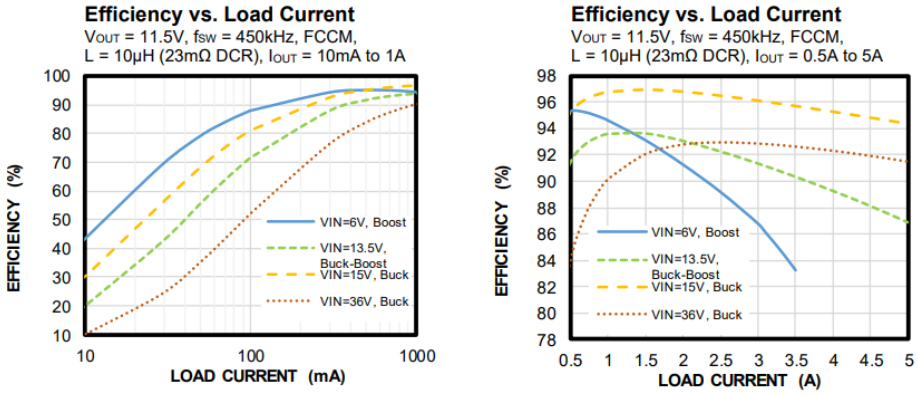

Figure 2: MPQ8875A Efficiency

The wide 2.2V to 36V V_{IN} can accommodate cold-crank conditions. If a cold crank occurs, the MPQ8875A is able to maintain a relatively stable V_{OUT} for optimal performance (see Figure 3).

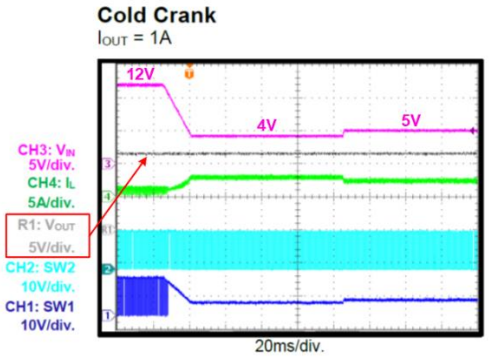

Figure 3: The MP8875A Under Cold-Crank Conditions

In terms of EMI performance, the MPQ8875A has built-in switching frequency jittering technology. The pins are also distributed on the package to facilitate a symmetrical capacitor layout design to improve EMI performance. These features meet stringent automotive standards (Figure 4).

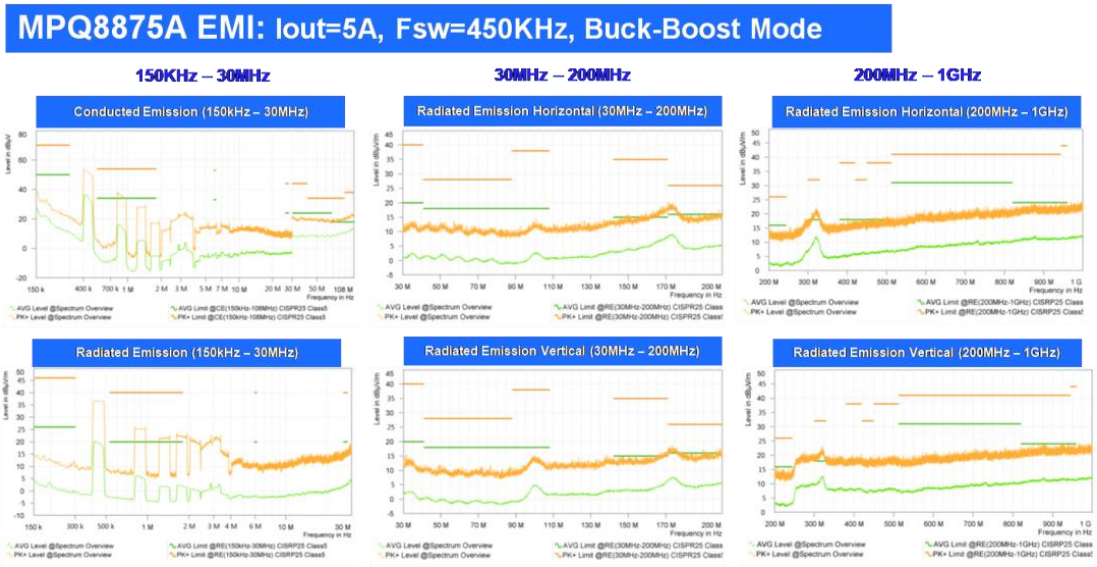

Figure 4: MPQ8875A EMI Performance

The EVQ8875A-VE-00A is a fully tested and assembled evaluation board designed to demonstrate the abilities of the MPQ8875A by testing for parameters including efficiency, load current, and V_{OUT} (see Figure 5).

Figure 5: The EVQ8875A-VE-00A Evaluation Board

Infrared LED Driver Solution with the MPQ4425B

Figure 6 shows the MPQ4425B, a high-frequency, synchronous buck LED driver with integrated power MOSFETs. It achieves 1.5A of continuous output current with excellent load and line regulation across a wide input supply range. Additional features include over-current protection (OCP), thermal shutdown (TSD), and fault indication for LED short and open faults.

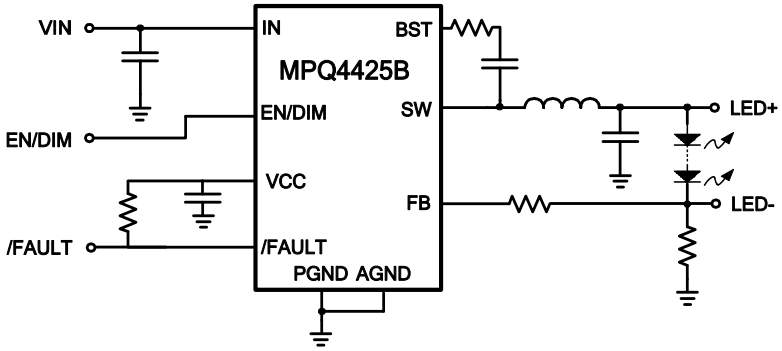

Figure 6: MPQ4425B Typical Application Circuit

The ultra-small QFN-13 (2.5mmx3mm) package is suitable for driving infrared LEDs in DMS and CMS cameras, and an alternate version of the part is available with wettable flanks (see Figure 7). The MPQ4425B is well-suited for applications with automotive LED lighting. This device supports LED open circuit protection, short-circuit protection (SCP), over-temperature protection (OTP), and fault feedback via the /FAULT pin.

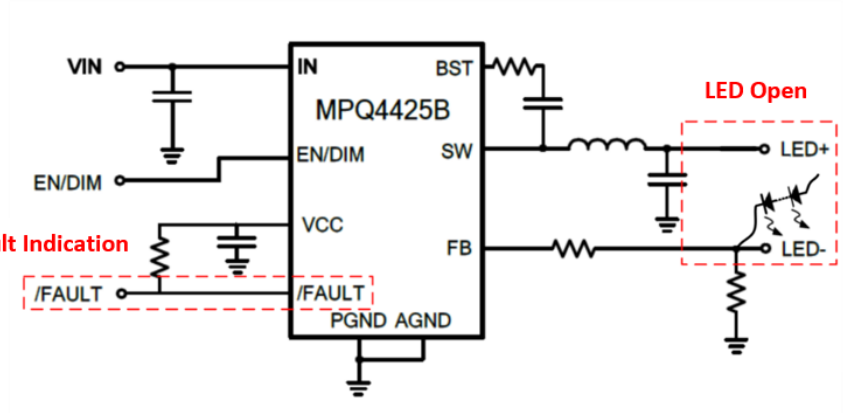

Figure 7: Fault Indication for the MPQ4425B

Conclusion

In this article, we discussed how the MPQ8875A and MPQ4425B help DMS and CMS cameras achieve stable, reliable power supplies while improving their infrared LED-based tracking capabilities. As the demands of intelligent driving become more complex, MPS's power management tools will continue to help designers implement cutting-edge features that emphasize safety, convenience, and efficiency.