Introducing the MPM3515-AEC1 Automotive Power Module

The MPM3515-AEC1 is a 36V, 1.5A, high-voltage, automotive-grade power module from Monolithic Power Systems (MPS). This part inherits the key advantages of the MPM module family: very compact size, ease of use, and high performance. It offers an output current of up to 1.5A with performance features tailored to automotive use, including AECQ grade 1 qualification, a high operating frequency of up to 2.2MHZ, and a wettable flank package that allows for easy reliability inspection during manufacturing.

The number of microprocessors, ASICs and sensors in vehicles is increasing rapidly as complex applications — from infotainment and smart lighting to ADAS (advanced driver assistance systems) and autonomous driving — become more and more popular. The need for power to drive these features means that board space is at a premium, and high power density solutions are essential. The MPM3515-AEC1 module provides a way to satisfy these power needs in a very compact form factor with minimal external components.

The MPM3515-AEC1 module is much smaller than a traditional discrete power solution of similar power level.

A traditional 36V, 1.5A DC/DC step-down converter design typically has a footprint of up to 45mmx20mm. The same design with the MPM3515-AEC1 needs only 7.5mmx7mm, a mere 6% of the original board area (see Figure 1).

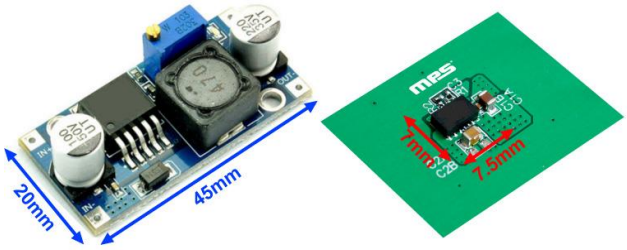

Figure 1: Small Solution Size

The MPM3515-AEC1 requires only four external components to complete the design of the entire power supply: input capacitance, output capacitance, and two feedback resistors to set the required output voltage (see Figure 2). All other components are contained within the module itself.

The MPM3515-AEC1 is a fully monolithic device incorporating a DC/DC controller and power MOSFETs on a single semiconductor die, unlike competitor products that use discrete components. The die and integrated inductor are mounted directly onto an internal lead frame using MPS's mesh connect package technology. This provides excellent thermal characteristics and low parasitic inductance. The simplicity of the design enables easy board layout and implementation.

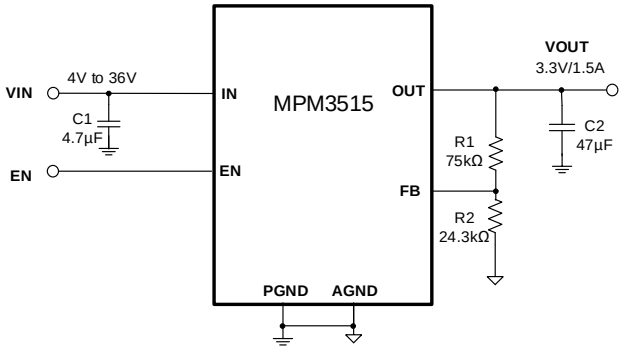

Figure 2: Typical Application Layout

The MPM3515-AEC1 achieves its very high power density in a small package just 3mmx5mm wide and 1.6mm high.

Forced continuous conduction mode (CCM) is used to ensure low output ripple at all load conditions for low EMI. The switching frequency can also be synchronized to an external clock from 450kHz to 2.2MHz for design applications that need to avoid specific frequency bands for better EMI control. MPS's advanced semiconductor processes mean that the on resistance of the integrated power MOSFETs is very low, typically 90mΩ/50mΩ for the high and low sides, respectively. This gives excellent efficiency up to 90.8% for a 12V input to 5V/1A output condition (see Figure 3).

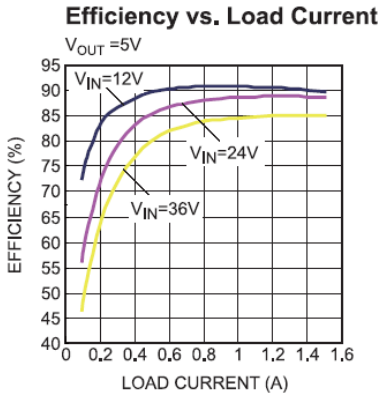

Figure 3: Typical Efficiency Curve

Protection features including internal over-current, short circuit, and over-temperature protection, and a power good (PG) output indicator make for an easy, hassle-free design.

Table 1 shows the MPM3515-AEC1's typical characteristics and the board space requirement compared to competitor solutions.

Table 1: Typical Characteristics and Requirements

Part Number	V_{IN} Range	I_{OUT}	f_{SW}	Efficiency at 12V to 5V/1A	Package Size
MPM3515-AEC1	4V to 36V	1.5A	450kHz to 2.2MHz	90.80%	3mmx5mmx1.6mm
Competitor 1	6V to 42V	1A	200kHz to 1MHz	92%	9.85mmx10.16mmx4.57mm
Competitor 2	3.6V to 36V	1A	200kHZ to 2.4MHz	88%	9mmx11.25mmx2.82mm

The superior performance and reliability of the MPM3515-AEC1 mean that it can be used in a wide range of applications, such as automotive cameras, industrial power supplies, medical imaging equipment, network and telecom equipment, and anywhere that space is at a premium (see Figure 4).

Figure 4: Application Uses for the MPM3515-AEC1