MPM38222 – A Simple, Compact Power Solution for Optical Modules

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Abstract

High efficiency, excellent thermal performances, small footprint, and low emissions become challenges for power solutions in high-speed, high-density optical modules. This article introduces the MPM38222, a high-performance, 6V input, dual 2A power module, which is suitable for optical modules and other space-limited applications. The total solution for a dual 2A resides in a 9mmx7mm area with 90% efficiency and can meet EN55022 Class B emissions. The MPM38222 is available in a small QFN-14 (4mmx4mmx1.6mm) package.

Introduction

High-speed, high-density optical modules are widely adopted as interfaces that connect fibers to copper networks, data centers, and most end points in optical networks. As more components are integrated into the modules, higher efficiency, better thermal performances, smaller footprint, and low emissions become challenges for the power solutions. MPS has created an easy and high-performance solution for optical modules and other space-limited power supplies. The proprietary packaging technology of MPS's power modules has given them an edge over other competitors. For space-limited power designs, the smallest solution size possible is often desirable with no performance compromise. With this in mind, MPS is proud to present their MPM38222 dual 2A module to the industry.

Small Package with Dual Outputs

Space matters in optical modules and similar products. The MPM38222 is a dual-channel DC/DC module in a compact 4x4x1.6mm package. It has two output channels, and each channel can supply up to 2A of current. Just two or three MPM38222 devices can cover most power rails in an optical module.

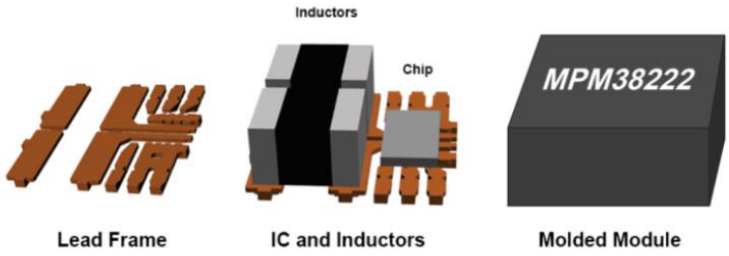
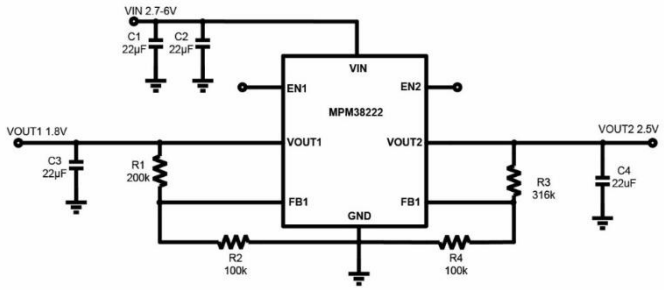


Figure 1: MPM38222 Assembly Process

Two chip inductors and the entire power stage are integrated inside the module (see Figure 1). As a result, compared to a discrete design solution, the MPM38222 only needs a minimal number of external components and functions as a full power system. Figure 2 shows the typical application circuit and layout for a 2.7V to 6V input, 1.2V/2A, and 1.8V/2A output applications. Only a few external ceramic capacitors and feedback resistors are required for each channel. The total solution size is only 9x7=63mm^2 of PCB area. The MPM38222 provides a simple power system that's easy to use, especially in space-limited applications.



MPM38222 Solution
7mmx9mm

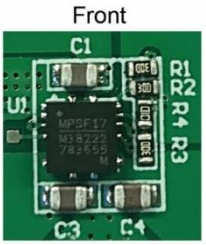


Figure 2: MPM38222 Typical Application and Layout

The MPM38222 operates from a 2.7V to 6V input, generates an output voltage as low as 0.608V, and has a 45µA quiescent current, making it ideal for powering portable equipment that runs on battery cells.

High Efficiency at Light Load

Optical modules usually operate at loads of hundreds of mA. The MPM38222 can achieve at least 90% efficiency between 10mA to 1A (see Figure 3).

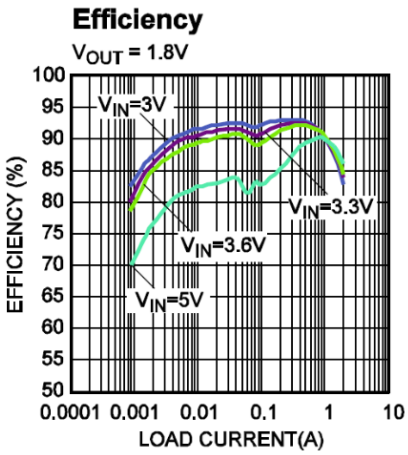


Figure 3: MPM38222 Efficiency vs. Load Current

In this load range, the MPM38222 uses a proprietary control scheme to save power and improve efficiency. The low-side switch is turned off when the inductor current starts to reverse and works in discontinuous conduction mode (DCM) operation. This helps skip pulses and reduce the switching frequency, minimizing switching loss.

Low-Noise Design

In addition to being small in size, the MPM38222 also has minimal EMI noise to its surroundings. Thanks to its high switching frequency, the MPM38222 can provide a clean output with peak-to-peak voltage ripple less than 20mV using only one 22µF 0603 ceramic capacitor. For the input side, the MPM38222 employs a 180° phase shift between the two channels, which minimizes the input voltage ripple. The MPM38222 is also engineered to meet low EMI standards. Figure 4 shows the MPM38222's radiated EMI performance (EN55022 Class B).

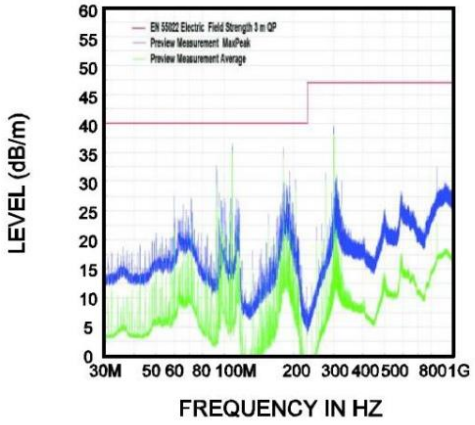
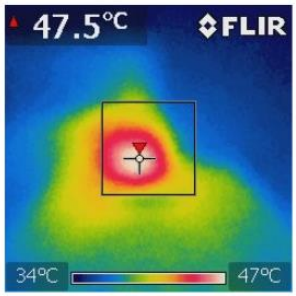


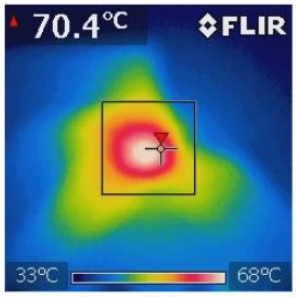
Figure 4: MPM38222 Radiated EMI Test

Good Thermal Performances

Figure 5a shows the thermal image for 5V input, 1.8V@1A, and 1.2A@1A, while Figure 5b shows the same voltage @ 2A load current for both channels. For 1A load conduction, the temperature rise for the MPM38222 is only 22°C above the ambient 25°C without heatsink or forced air flow. For a 2A condition, the temperature rise is only 45°C. This excellent thermal performance enables the MPM38222 to work stably in a constraint space environment with high ambient temperature.



a. 5V Input, 1.8V@1A, 1.2A@1A



b. 5V Input, 1.8V@2A, 1.2A@2A

Figure 5: MPM38222 Thermal Image

Protection Features

The MPM38222 includes various protection features to ensure a reliable and safe design.

1) Soft start: A soft start with a controlled slew rate helps prevent input current overshoot during power-up.
2) Over-current protection and hiccup: The MPM38222 limits the peak-current limit on a cycle-by-cycle basis. The device enters hiccup mode when the output is shorted to ground.
3) Thermal shutdown: The MPM38222 shuts down the device when its junction temperature reaches 160°C.

For more detailed protection features, please refer to the MPM38222 datasheet.

Conclusion

The MPM38222's high efficiency, low noise, and small size make it a great candidate for optical modules and other space-limited designs. The highly integrated module helps ease the design and shortens the time to market.