Low EMI, Silent Switcher, 1.2 A µModule Regulator in 4 mm × 4 mm × 1.82 mm BGA Package

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Introduction

Crowded application boards leave little space for high performance dc-to-dc POL converters. Furthermore, electromagnetic interference (EMI) is a significant concern at high component densities, limiting the field of acceptable power solutions. The LTM8074 µModule® regulator easily meets these limiting factors. It is compact, enabling it to fit in limited topside PCB space or on the backside of the PCB because of its low profile. The LTM8074 features the Silent Switcher® architecture, enabling it to pass stringent EMI testing without additional filtering or shielding components, which simplifies design and production.

1.2 A Silent Switcher µModule Regulator

The LTM8074 is a complete, ultralow EMI, high voltage input and output, dc-to-dc step-down switching power supply. The controller, power switches, inductor, and all support components are included in a low profile 4 mm × 4 mm × 1.82 mm surface-mount RoHS-compliant BGA package (Figure 1), enabling utilization of unused space on the bottom of PC boards for high power density point-of-load regulation.

The LTM8074 operates over an input voltage range of 3.4 V to 40 V and output voltages from 0.78 V to 15 V. The output voltage is precisely regulated while delivering output current to 1.2 A. High efficiency and a thermally enhanced packaging enable excellent thermal performance and high power density. Figure 2 shows the LTM8074 under loaded conditions with minimal rise in case temperature and low thermal resistance.

Figure 1. The LTM8074 uses Silent Switcher architecture for a complete low noise solution in a tiny package.

The internal controller's peak current-mode control architecture enables fast transient response and good loop stability. Figure 3 shows fast transient response and low peak-to-peak voltage deviation in the output voltage.

Design is simplified by optimized internal feedback loop compensation, which provides sufficient stability margins under a wide range of operating conditions with a broad range of output capacitors. The LTM8074 features Silent Switcher architecture, which minimizes radiated emissions, allowing it to easily meet stringent electromagnetic compatibility standards.

Figure 2. At room temperature (23°C), the LTM8074 has low temperature rise under full load (12 V input to 5 V output at 1 A).

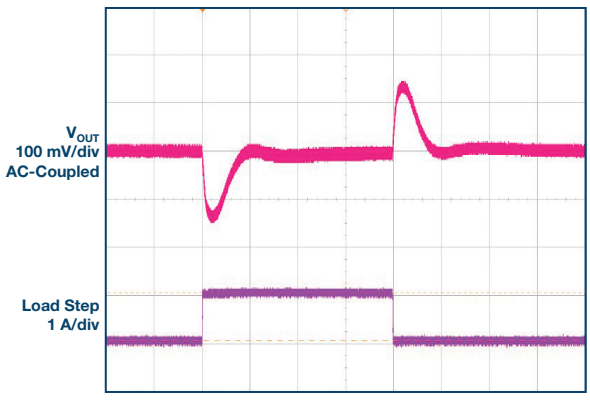

Figure 3. With minimal output capacitors (2 µF × 4.7 µF ceramics), the LTM8074 provides a quick transient response (12 V_{IN}, 3.3 V_{OUT}).

Fits into Tight Spots

All support components are integrated into the LTM8074's compact form factor, simplifying layout design and reducing solution size. Only input and output capacitors, frequency, and voltage setting resistors are necessary to complete the design. A typical application circuit and its efficiency are shown in Figure 4 and Figure 5, respectively.

Although the LTM8074's µModule design results in a nearly self-contained, drop-in regulator, a number of design parameters are easily adjustable to meet the needs of specific applications. The output voltage and operating frequency are resistor programmable and the operating frequency can be set to synchronize to an external clock. The LTM8074 also features programmable soft-start, output voltage tracking, power good indicator, and enable control, as well as a variety of conduction mode options, including pulse-skipping mode, Burst Mode® operation and spread spectrum modulation, further optimizing light load efficiency and EMI performance.

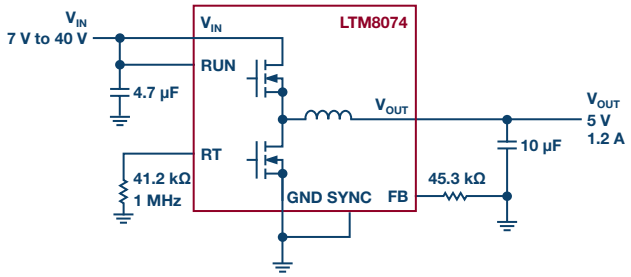

Figure 4. Minimal components needed for 7 V to 40 V input, 5 V_{OUT} 1.2 A design.

Ultralow Noise: CISPR 22 Class B

Switching regulators naturally produce radiated EMI, as their operation requires high dI/dt events at relatively high frequency. Instead of relying on cumbersome EMI mitigation techniques—such as lowering the switching frequency, adding filter circuitry, or installing shielding—the LTM8074's low EMI performance is a result of a built-in, proprietary Silent Switcher architecture. No external circuitry or special layout techniques are necessary to meet radiated EMI standards, such as CISPR 22 Class B, as shown in Figure 6 and Figure 7.

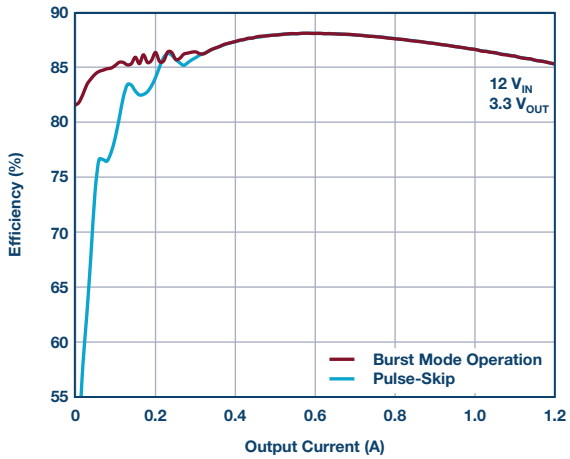

Figure 5. LTM8074 typical efficiency.

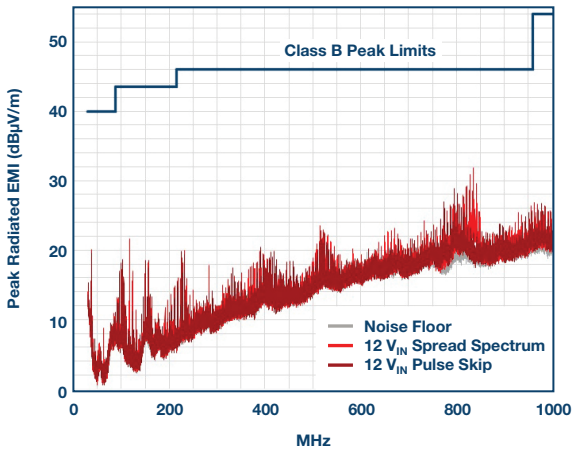

Figure 6. EMI performance vs. CISPR 22 Class B for 12 V_{IN} to 3.3 V_{OUT} at 1.2 A (3 meter, peak, vertical antenna, no EMI filter).

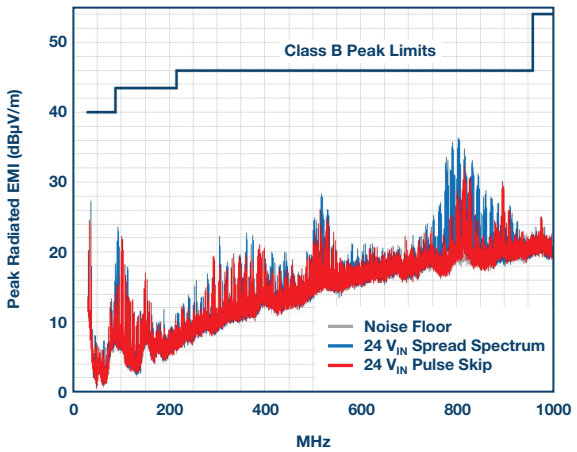

Figure 7. EMI performance vs. CISPR 22 Class B for 24 V_{IN} to 3.3 V_{OUT} at 1.2 A (3 meter, peak, vertical antenna, no EMI filter).

Conclusion

The LTM8074 is a compact 1.2 A point-of-load µModule regulator that covers a wide range of input and output voltages. It features a Silent Switcher architecture for built-in low EMI performance and design-friendly adjustability, enabling it to meet the requirements of a wide range of applications, from portable devices to heavily populated industrial boards.

About the Author

Austin Luan is currently a product applications engineer for Analog Devices' Power Products from the Power by Linear™ product group. He is responsible for supporting customers and field applications engineers with µModule regulators and power management controllers. He attained a B.S. and an M.S. in electrical engineering from California Polytechnic State University, San Luis Obispo. He can be reached at *austin.luan@analog.com*.

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