

Design Note

Low EMI, Silent Switcher, 1.2A μ Module Regulator in 4mm \times 4mm \times 1.92mm BGA Package

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Introduction

Crowded application boards leave little space for high performance DC/DC POL converters. Furthermore, electromagnetic interference (EMI) is a significant concern at high component densities, limiting the field of acceptable power solutions. The LTM[®]8074 μ Module regulator easily meets these limiting factors. It is compact, enabling 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, simplifying design and production.

1.2A Silent Switcher μ Module Regulator

The LTM8074 is a complete, ultralow EMI, high voltage input and output, DC/DC step-down switching power supply. The controller, power switches, inductor and all support components are included in a low profile 4mm \times 4mm \times 1.92mm 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 3.4V to 40V and output voltages from 0.78V to 15V. The output voltage is precisely regulated while delivering output current to 1.2A. 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.

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

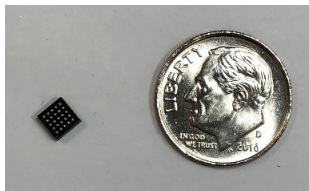


Figure 1. The LTM8074 Uses Silent Switcher Architecture for a Complete Low Noise Solution in a Tiny Package



Figure 2. At Room Temperature (23°C), the LTM8074 Has Low Temperature Rise Under Full Load (12V Input to 5V Output at 1A)

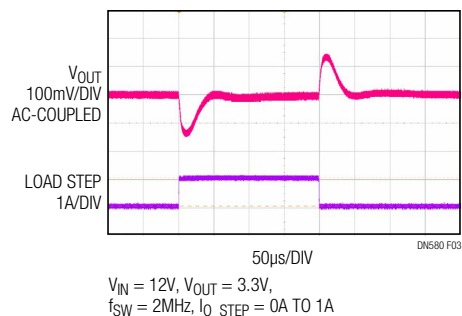


Figure 3. With Minimal Output Capacitors (2 \times 4.7 μ F Ceramics), the LTM8074 Provides a Quick Transient Response (12V_{IN}, 3.3V_{OUT})

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.

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 Figures 4 and 5, respectively.

Although the LTM8074's μ Module 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.

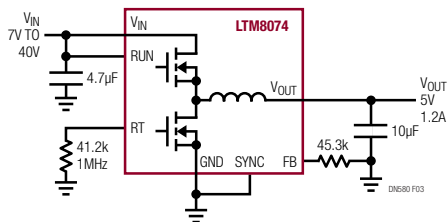


Figure 4. Minimal Components Needed for 7V to 40V Input, 5V_{OUT} 1.2A Design

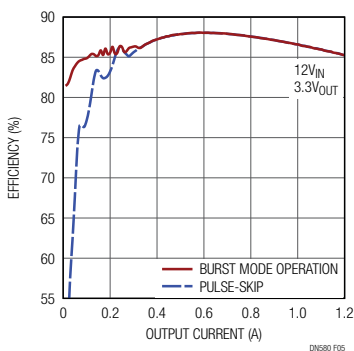


Figure 5. LTM8074 Typical Efficiency

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 Figures 6 and 7.

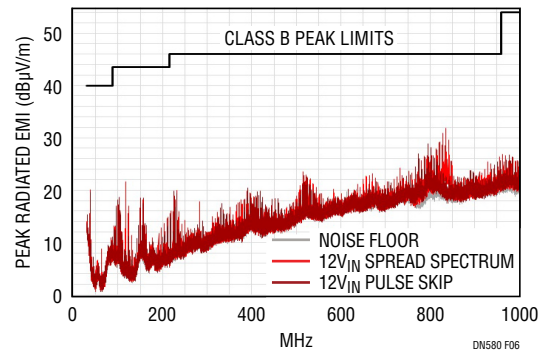


Figure 6. EMI Performance vs CISPR 22 Class B for 12V_{IN} to 3.3V_{OUT} at 1.2A (3 meter, Peak, Vertical Antenna, No EMI Filter)

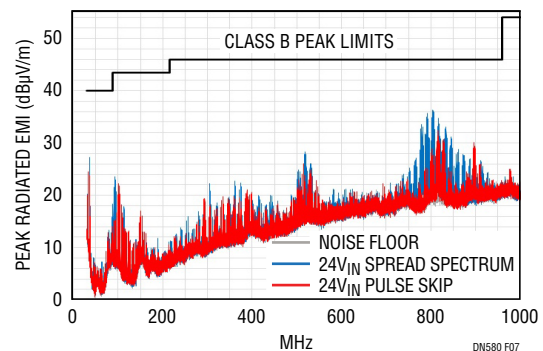


Figure 7. EMI Performance vs CISPR 22 Class B for 24V_{IN} to 3.3V_{OUT} at 1.2A (3 meter, Peak, Vertical Antenna, No EMI Filter)

Conclusion

The LTM8074 is a compact 1.2A point-of-load μ Module 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.