

Dual 13A μ Module Regulator with Digital Interface for Remote Monitoring & Control of Power

Design Note 524

Jian Li and Gina Le

Digital Power System Management: Set, Monitor, Change and Log Power

Managing power and implementing flexibility in a high rail count circuit board can be challenging, requiring hands-on probing with digital voltmeters and oscilloscopes, and often rework of PCB components. To simplify power management, especially from a remote location, there is a trend to configure and monitor power via a digital communications bus. Digital power system management (PSM) enables on-demand telemetry capability to set, monitor, change and log power parameters.

Dual μ Module[®] Regulator with Precision READ/WRITE of Power Parameters

The LTM4676 is a dual 13A output constant frequency switching mode DC/DC μ Module (micromodule) regulator (Figure 1). In addition to delivering power at a point-of-load, the LTM4676 features configurability and telemetry-monitoring of power and power management parameters over PMBus— an open

standard I²C-based digital serial interface protocol. The LTM4676 combines best-in-class analog switching regulator performance with precision mixed signal data acquisition. It features $\pm 1\%$ maximum DC output voltage error and $\pm 2.5\%$ current read back accuracy over temperature ($T_J = -40^\circ\text{C}$ to 125°C), and integrated 16-bit delta-sigma ADC and EEPROM.

The LTM4676's 2-wire serial interface allows outputs to be margined, tuned and ramped up and down at programmable slew rates with sequencing delay times. Input and output currents and voltages, output power, temperature, uptime and peak values are readable. The device is comprised of fast, dual analog control loops, precision mixed signal circuitry, EEPROM, power MOSFETs, inductors and supporting components housed in a $16\text{mm} \times 16\text{mm} \times 5.01\text{mm}$ BGA (ball grid array) package.

LT, LTC, LTM, Linear Technology, the Linear logo and μ Module are registered trademarks and LTPowerPlay is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.

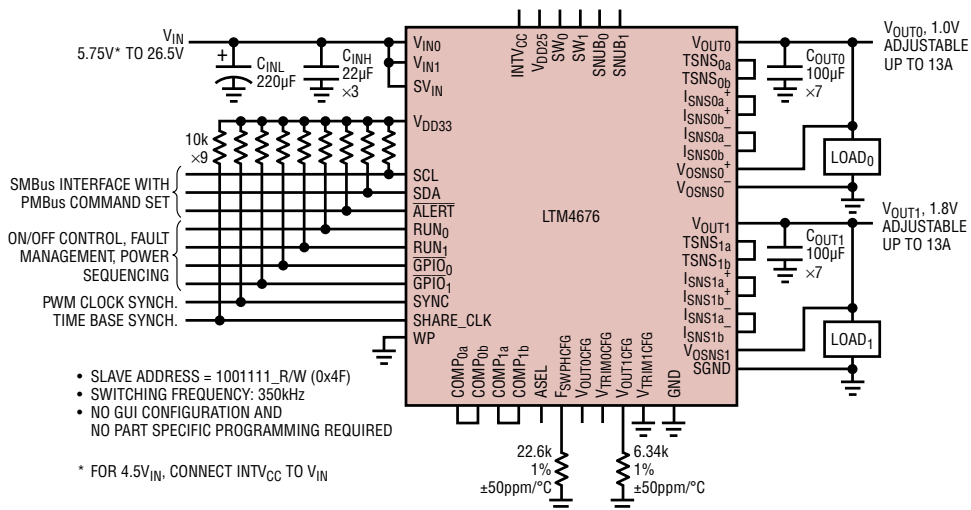


Figure 1. LTM4676: Dual 13A Output μ Module Regulator with PMBus Interface

The LTM4676 operates from a 4.5V to 26.5V input supply and steps down V_{IN} to two outputs ranging from 0.5V to 5.4V. Two outputs can current share to provide up to 26A (i.e., 13A + 13A as one output).

Internal or External Compensation

The LTM4676 offers both internal or external compensation, which can optimize the transient response over a wide operating range. Figure 2 shows that the peak-to-peak output voltage is only 94mV with a 50% load step.

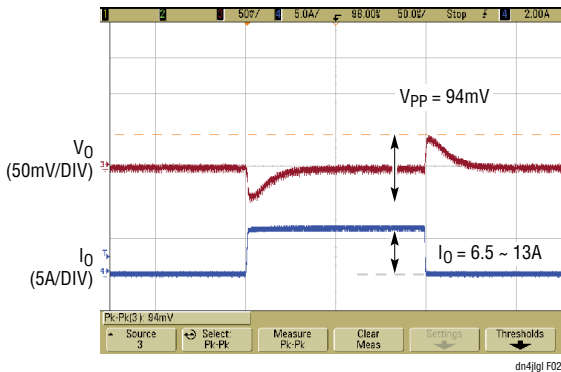


Figure 2. Transient Response of the LTM4676 in Figure 1 at $V_{IN} = 12V$, $V_{OUT1} = 1.8V$, $I_O = 6.5A \sim 13A$

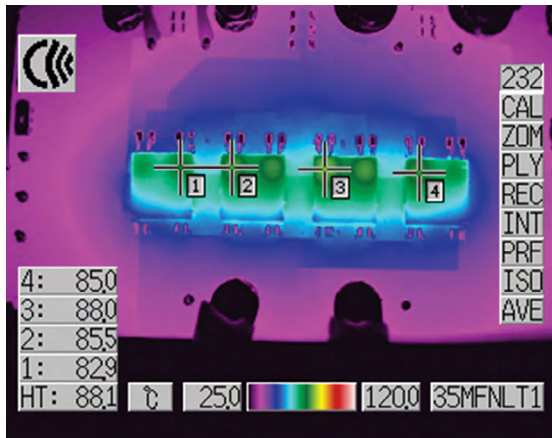


Figure 3. Four LTM4676 Current Sharing: Thermal Picture at $V_{IN} = 12V$, $V_{OUT} = 1.0V/100A$, 300LFM Airflow

Current Share for up to 100A at 1V_{OUT}

The LTM4676 uses a constant frequency peak current mode control architecture, which offers a cycle-by-cycle current limit and easy current shar-

ing among multiple phases. Paralleling modules can achieve much higher output current capability. For example, four LTM4676 μ Module regulators can be paralleled to provide up to 100A output current. Figure 3 shows the thermal picture. With 300LFM of airflow, the hot spot temperature rise is only 64.3°C. The even thermal distribution among modules is due to excellent current sharing performance. Figure 4 is a photo of the demo board with four LTM4676 μ Module regulators assembled to provide 100A at 1V.

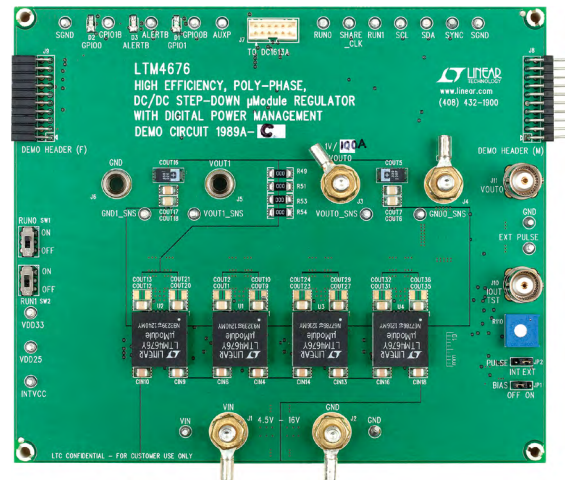


Figure 4. Four LTM4676, Each in a 16mm × 16mm × 5.01mm LGA Package Deliver 100A at 1V_{OUT}.

Conclusion

Linear Technology's digital power system management (PSM) products provide users with critical power-related data. One can access load current, input current, output voltages, compute power consumption, efficiency, and access other power management parameters via a digital bus. This enables predictive analytics, minimizes operating costs, increases reliability and ensures smart energy management decisions can be made.

On-demand digital control and monitoring of system power with the LTM4676 eliminates PCB layout and circuit component manipulation and accelerates system characterization, optimization and data mining during prototyping, deployment and field operation.

For demo kits, free download of the LTPowerPlay™ GUI and PSM training videos, please visit www.linear.com and type "PSM" in the SEARCH box.

Data Sheet Download

www.linear.com/LTM4676

For applications help,
call (408) 432-1900, Ext. 3578