

DESIGN NOTES

6A Monolithic Synchronous DC/DC Step-Down Converter with Digital Power System Management

Design Note 554

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Digital Power System Management (PSM) controllers usually target high current point-of-load (POL) applications. Lower current applications, with up to 6A load current, can also benefit from PSM features. The **LTC[®]3815** is a 6A monolithic synchronous step-down converter with digital power monitoring and control features.

The LTC3815 uses a phase lockable controlled on-time, constant frequency, current mode architecture, that provides extremely fast load step transient response with minimum output capacitance. It also enables operation at the very low on-times required to regulate low output voltages at high switching frequencies for minimum solution size. The output voltage is programmable from 0.4V to 72% of the input voltage with a single external resistor or with an external voltage reference through the reference (REF)

input pin. The operating supply voltage range is from 2.25V to 5.5V, making it suitable for operation from 2.5V, 3.3V or 5V input rails or lithium-ion batteries.

6A Converter at 1MHz

Figure 1 shows a typical application with an input voltage range of 2.25V to 5.5V and an output of 1.8V at 6A.

The efficiency curve for the circuit in Figure 1 is shown in Figure 2. Since the LTC3815 can achieve relatively high efficiency even at 1MHz, a small inductor can be used to minimize the total footprint and board size, making this part especially suitable for applications where board space or component height is limited.

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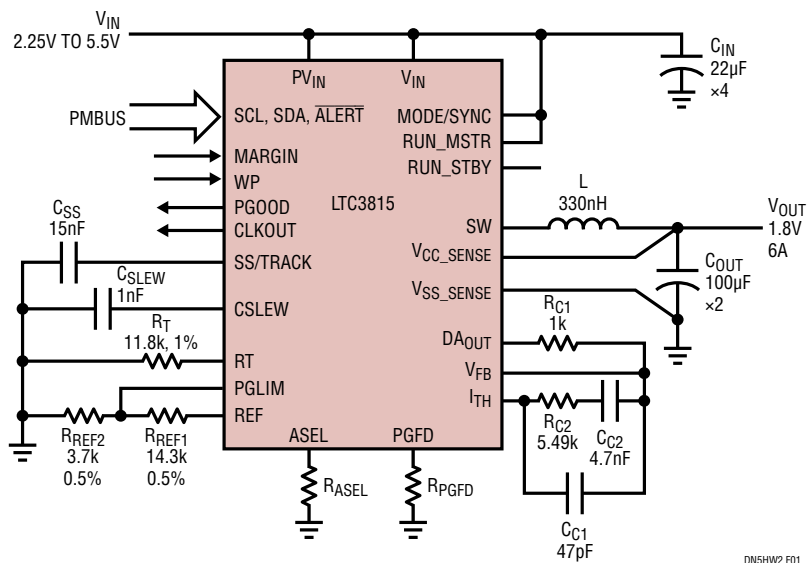


Figure 1. A 1MHz, 1.8V/6A Output High Efficiency Converter Featuring the LTC3815

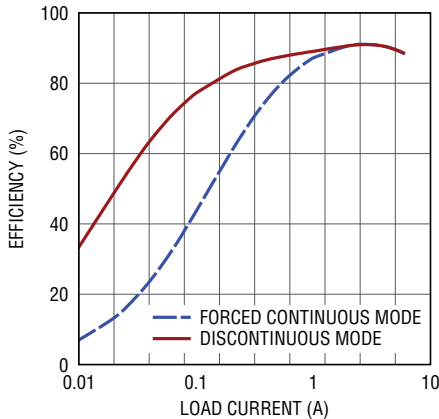


Figure 2. Efficiency Curves at $V_{IN} = 5V$, $V_{OUT} = 1.8V$, $f_{sw} = 1MHz$ (for the Circuit in Figure 1)

Figure 3 shows the thermal footprint of the LTC3815 at full load. The IC remains cool at full load even without airflow—the temperature rise at the hot spot is only 37.4°C.

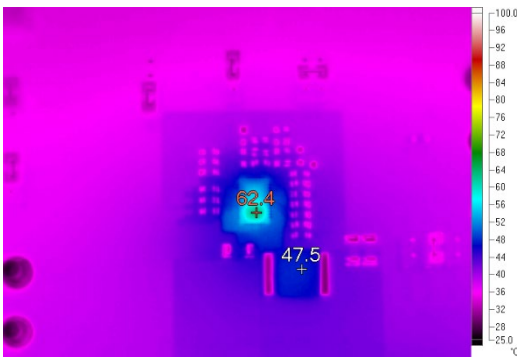


Figure 3. Thermal Picture @ $V_{IN} = 5V$, $V_{OUT} = 1.8V/6A$, $f_{sw} = 1MHz$, No Airflow, $T_A = 25^\circ C$ (for the Circuit in Figure 1)

Power System Management Features

The LTC3815 includes a number of PSM functions, including digital control of output margining ($\pm 25\%$ with 0.1% resolution) readback of fault status and monitoring of time-averaged ($\sim 4ms$) and peak input/output current, input/output voltage and temperature. The LTC3815 does not have internal NVM (nonvolatile memory), but the output voltage can be set through PMBus. PSM functions can be accessed using Linear’s free LTpowerPlay® software, an easy to use PC-based GUI, shown in Figure 4.

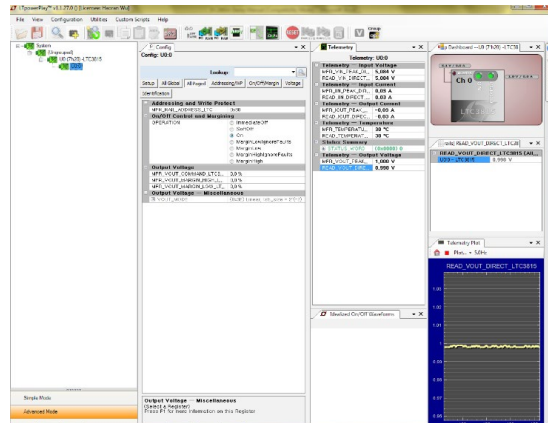


Figure 4. LTpowerPlay Main Interface

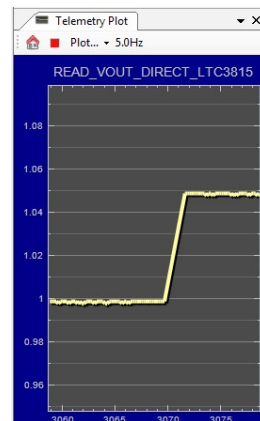


Figure 5. Telemetry Plot after Issuing a MarginHigh Command through LTpowerPlay

For example, to margin V_{OUT} to the margin high value, in LTpowerPlay, simply change OPERATION to MarginHigh, then click the “W (PC to RAM)” icon to write these register values to the LTC3815. When the write is successful, the output voltage jumps to 1.05V on the telemetry plot (Figure 5).

Conclusion

The LTC3815 is a 6A monolithic synchronous buck regulator with digital power system management. It offers a comprehensive solution for applications requiring simple, compact and high efficiency design as well as digital configuration and monitoring functions usually reserved for much higher power POL converters.

Data Sheet Download

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