Gulliver’s Miniature Power Supply Designs

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Developers are faced with a systems landscape that is in constant change. As complexity increases, so do power management requirements. New features like camera flash light drivers, built-in projectors, communications and application-specific processors require a larger number of different power rails. Power management units (PMUs) can be a first approach for complex processors like OMAPTM. However, often there are more functional blocks on the PCB that cannot be centrally supplied because of their remote location, or the PMU doesn’t have enough channels to support these functions. Here, designers can benefit from a single-channel, small solution size regulator.

Many times a simple linear regulator (LDO) can be a quick and good enough solution. Typically, only an input and output capacitor is required around the IC to complete the solution. This minimizes the design effort and allows finishing the task fairly quickly.

The drawback with battery-operated devices, however, is application run time. Furthermore, non-portable applications fall under government-driven regulations, so they need to meet tough overall power consumption goals. In these instances, LDO solutions often do not support efficiency needs, so a high-efficiency DC/DC converter is required.

Initially, a DC/DC solution might look controversial in terms of a larger footprint, since an additional inductor is needed. Also, DC/DC controllers or non-synchronous regulators need even more external components, so complexity and solution size are increased.

However, the integration levels of these converters have increased significantly, so it is possible to achieve very high-power densities with a minimum of external components.

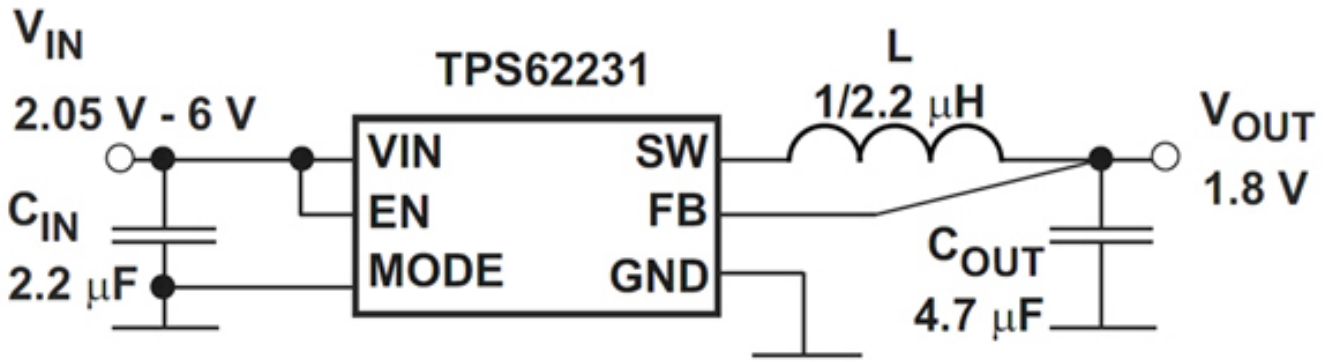

Figure 1. DC/DC converter with a 12mm2 footprint.

One way to manage solution size is by increasing switching frequency. For example, 10 years ago a 600 mA output current solution needed a footprint of about 170mm2. Today. this output current can be supplied from a regulator occupying only 12mm2 (Figure 1).

Switching frequencies of about 3 to 6 MHz help to minimize the physical size of the external components, which has a positive effect on the overall bill of material (BOM) cost.
Another enabler to a highly efficient and small solution size is that the regulation architectures are no longer based only on classic topologies like current mode or voltage mode. Moreover, the IC contains a mix of multiple topologies and is optimized for a specific target market. These new switching architectures enable high-efficiency levels of over 90 percent.

Alongside high efficiency and small solution size, these regulators support very fast AC line and load-transient response, as well as very high power supply rejection ratio (PSRR) (up to 90 dB). In combination with frequency-dithering topologies, the perception that DC/DC regulation is noisy can be debunked, so these converters become a truly good alternative to LDO solutions.

Moving towards an even further size reduction, high switching frequencies enable new approaches and allow for even higher integration. Discrete components can be shrunk in size plus the chip itself, so components can be stacked. For example, the PicoStar™ package from TI enables the device to be embedded into a substrate, on which the required input/output and inductor are placed.

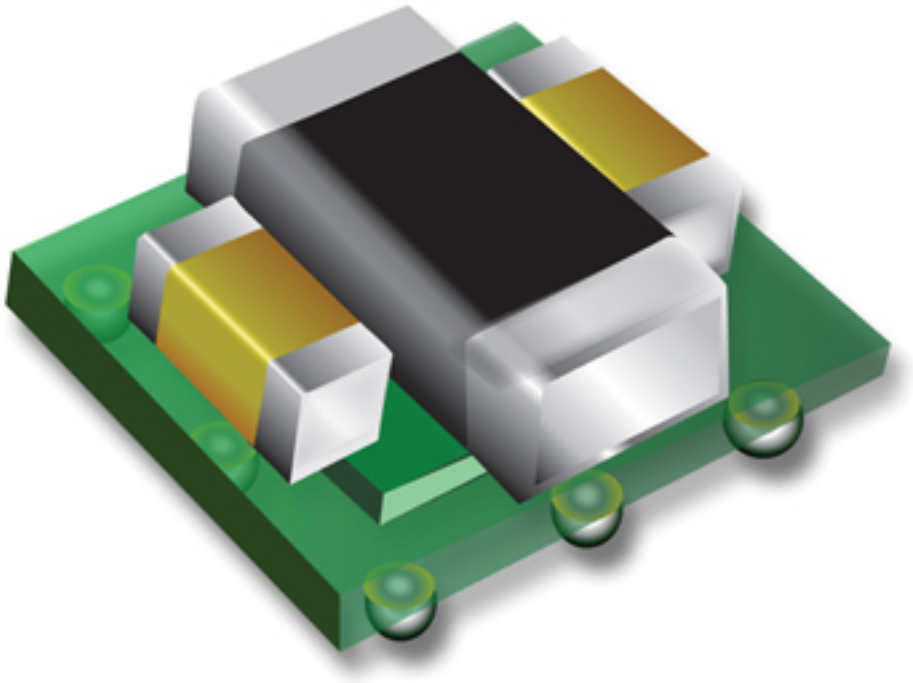

Figure 2. Example of a new MicroSiPTM package.

In Figure 2, this unique MicroSiP package from TI reduces the solution size even further to only 6.7 mm2 with a maximum height of 1 mm.

For more information about package miniaturization, visit: www.ti.com/tps82671 [1].

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Links:
[1] http://www.ti.com/tps82671
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