Technical Article

Choosing Buck Converters and LDOs for Miniature Industrial Automation Equipment

Arief Hernadi

As the factory automation and control equipment market evolves, shipments of equipment with sensors such as field transmitters, machine vision and position sensors are increasing. As a result, the demand for feature-rich power integrated circuits (ICs) that could power these devices is also growing.

Figure 1 shows a block diagram of a temperature transmitter. The nonisolated power-supply subsystem (highlighted in red) consists of a low dropout regulator (LDO), a DC/DC converter or a power module. In an earlier technical article, "Powering tiny industrial automation control equipment with high-voltage modules: how to ensure reliability," my colleague Akshay Mehta explained how to power miniature industrial automation control equipment with high-voltage modules. In this article, I'll take a look at how to use buck converters and LDOs for the same purpose.

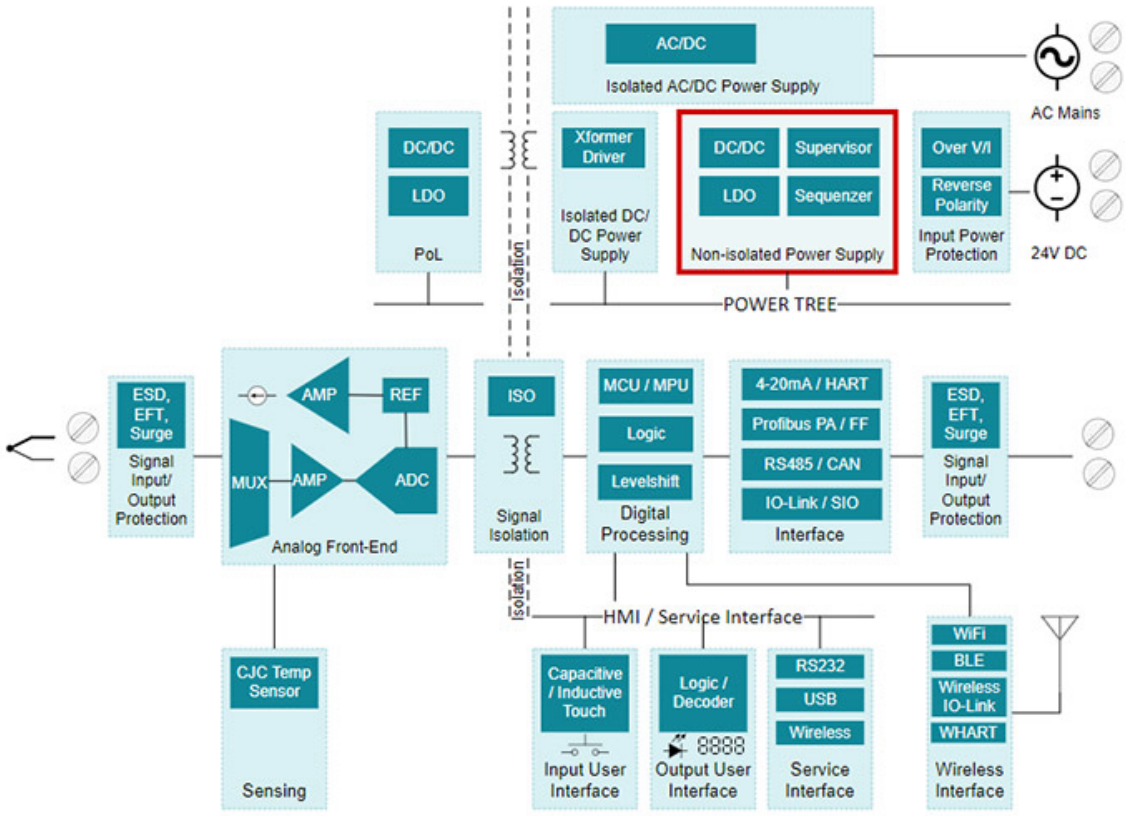
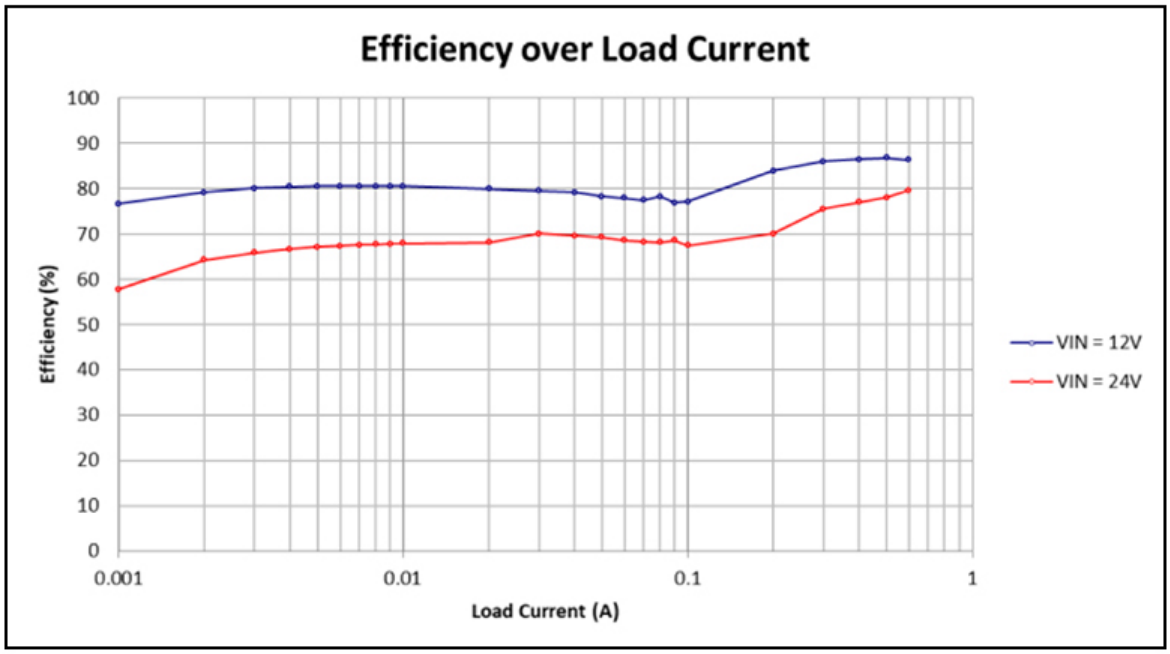


Figure 1. Temperature Transmitter Subsystem

High Input Voltage, Higher Stakes

There are a number of ways to regulate the input DC voltage in factory automation and control equipment. You can use an LDO, a DC/DC converter or a power module. LDOs such as the TPS7A47 are commonly used in

sensor power supplies due to their simple design and ability to attenuate input noise and deliver a ripple-free output voltage. DC/DC converters are a good choice for applications operating at lower output voltages, higher input voltages or higher output currents. For example, the LMR36503 and LMR36506 DC/DC converters enable a low shutdown current specification of 1 µA and an operating quiescent current specification of 7 µA. For loads with low output currents – less than 20 mA – these performance specifications ensure higher efficiency for 4- to 20-mA loop applications. Figure 2 shows the efficiency and thermal performance of the LMR36506 converter.



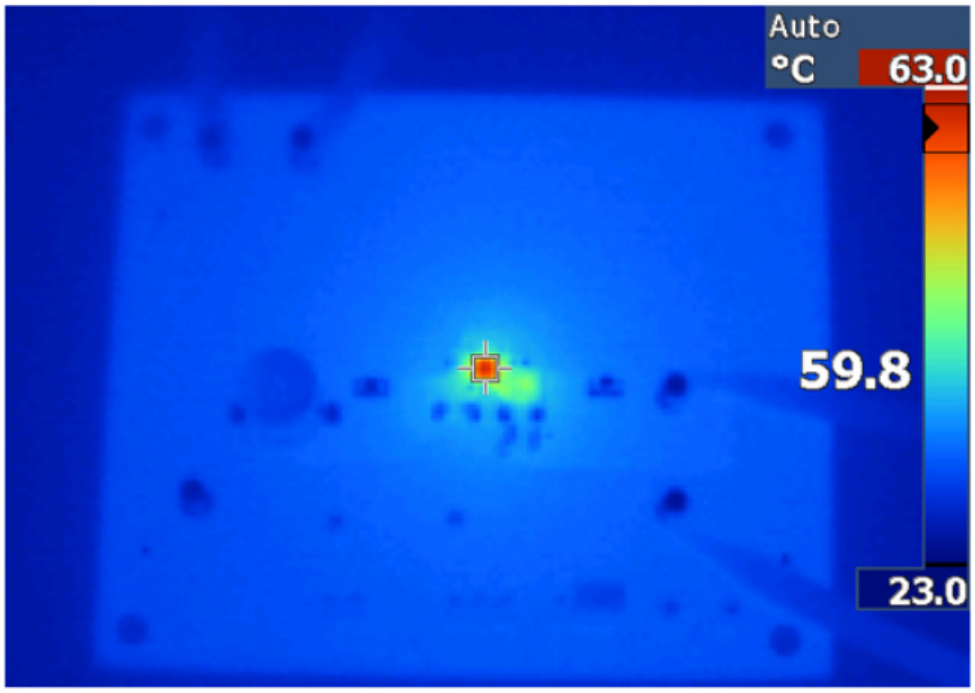


Figure 2. Efficiency and Thermal Performance at 24 v_{IN}, 5 V_{OUT}, 2.1 Mhz at 0.6A

Big Challenge, Small Solution

TPSM265R1 LMR36503 LMR36506 IN OUT

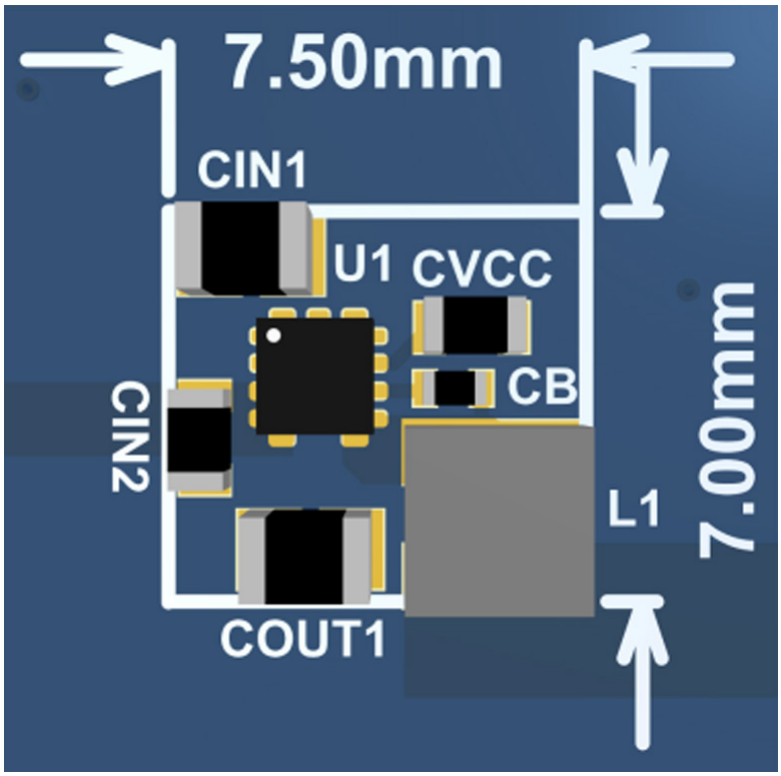


Figure 3. LMR36506 Example Solution Size

Lowering EMI, Raising the Standard

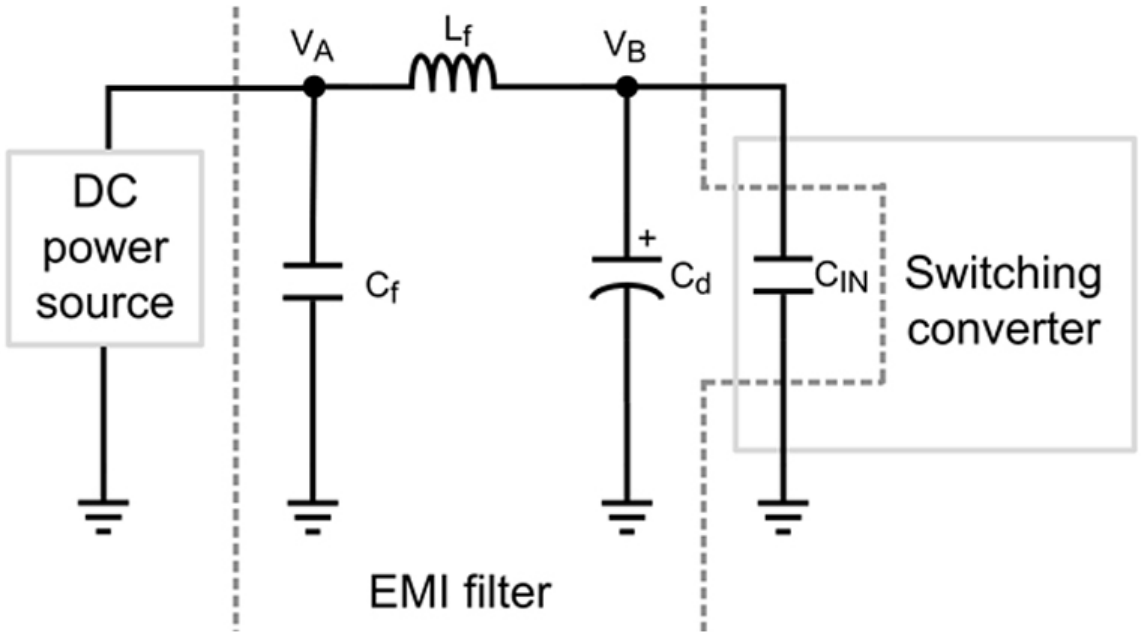


Figure 4. An EMI Filter Structure for DC/DC Converters

LMR36503 LMR36506

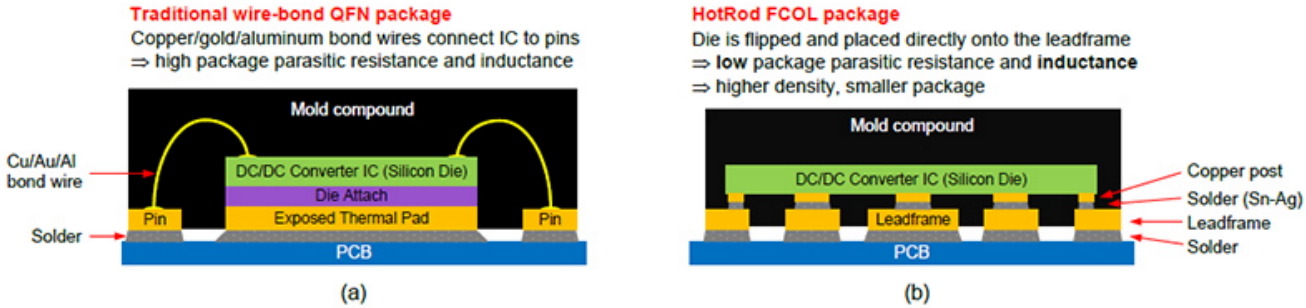


Figure 5. Wire-bond Quad Flat No-lead and FCOL Packages

Conclusion

LMR36506

Additional Resources:

- If you're considering using modules to power your solution, read our technical article: Powering tiny industrial automation control equipment with high-voltage modules: how to ensure reliability

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265