Embedded Inductor Enables Tiny Size, Low EMI For Buck Converters

Murata Americas describes its LXDC2UR and LXDC3EP series as the world’s smallest dc-dc converters. Rated at 600 mA and 1-A, respectively, these high-efficiency, fixed-output-voltage synchronous buck converters leverage Murata's proprietary materials and technical capabilities—ferrite material expertise, multilayer processing, and power module design—to achieve very small size together with EMI noise suppression. The LXDC2UR and LXDC3EP “micro” dc-dc converters feature inductors embedded within their substrates and I/O capacitors in the same package (Fig. 1.) Murata also provides the LXDC55B series, available at 3 A.

Originally introduced back in February by Murata Manufacturing Co., Ltd., the LXDC2UR and LXDC3EP series were released by Murata Americas earlier this month. Murata Americas is the group of Murata companies located in North and South America. The regional HQ of Murata Americas is Murata Electronics North America, Inc., which is a wholly owned subsidiary of Murata Manufacturing Co., Ltd.

A key feature of the LXDC line is the embedding of the power inductor within the actual ferrite substrate. By using this structure, the IC can be mounted directly above the power inductor coil with almost no pattern length, which diminishes leakage radiation noise (Fig. 2). The I/O connections are also routed through this same ferrite substrate to create a function similar to ferrite beads that significantly reduces conductive noise. Lastly, board space is greatly decreased when using this product versus other discrete surface-mount designs (Fig. 3.)

"Murata achieved a ferrite substrate with an embedded inductor and EMI filter feature by leveraging our expertise and leadership in material engineering, multi-layer processing, and circuit design," says Geoff Brock, marketing manager, Murata Americas. "We are confident that the LXDC series will greatly contribute to further miniaturizing mobile devices while continuing to provide greater functionality that the market demands."

According to Brock, the company is already shipping these micro dc-dc converters. "Our largest customers are for smartphones and digital cameras," says Brock.

Other features of these devices include:

- Selectable operating mode—either PWM forced or PFM/PWM auto-select
- Input range of 2.7 to 5.5 V (LXDC2UR) or 2.5 to 5.5 V (LXDC3EP)
- Output range of 1.2 to 3.3 V (LXDC2UR) or 1.0 to 3.3 V (LXDC3EP)
- Switching frequency of 6 MHz (LXDC2UR) or 4 MHz (LXDC3EP)

The LCDC2UR series is priced at $1.69, and the LXDC3EP is $1.95, depending on purchasing volume. Datasheets for the LXDC2UR and LXDC3EP are available now.
Fig. 1. Structure of Murata’s micro dc-dc converters and internal functional diagram. Rated for output currents of 600 mA and 1-A, respectively, LXDC2UR and LXDC3EP micro dc-dc converters embed the power inductor within their substrates and mount the I/O capacitors on their substrates, creating a buck converter module that measures just 2.5 mm nom. x 2.3 mm nom. x 1.2 mm max (LXDC2UR) or 3.5 mm nom. x 3.2 mm nom. x 1.3 mm max (LXDC3EP).

Fig. 2. Embedding the power inductor within the dc-dc converter’s ferrite substrate, allows the buck converter IC to be mounted directly above the inductor with almost no pattern length. This reduction in the exposed interconnect path reduces radiated EMI leakage radiation noise dramatically when compared with the emissions of a comparable discrete dc-dc converter design as demonstrated in these measurements.
Fig. 3. A comparison of Murata’s LXDC2UR series dc-dc converter (shown on right) with discrete solutions and the company’s previously introduced 2HL series (a). The 2HL series uses a similar ferrite substrate technology as the 2UR series, but that earlier series only has one capacitor on its substrate. (Two more are required on the customer’s board.) A typical application circuit for the 1-A converter reveals that the use of an external 4.7-μF capacitor is optional (b).