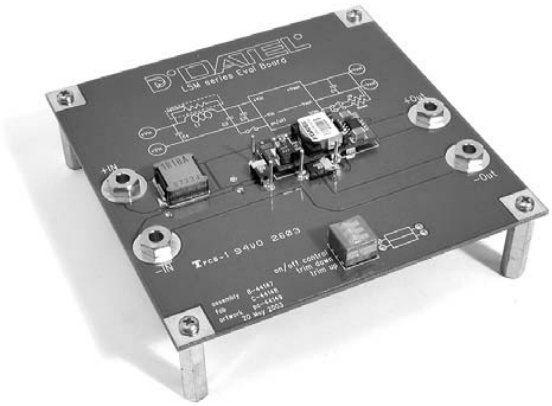
Murata Power Solutions

# LSM-EB Series

## 10 Amp DC/DC Power Converter Evaluation Boards



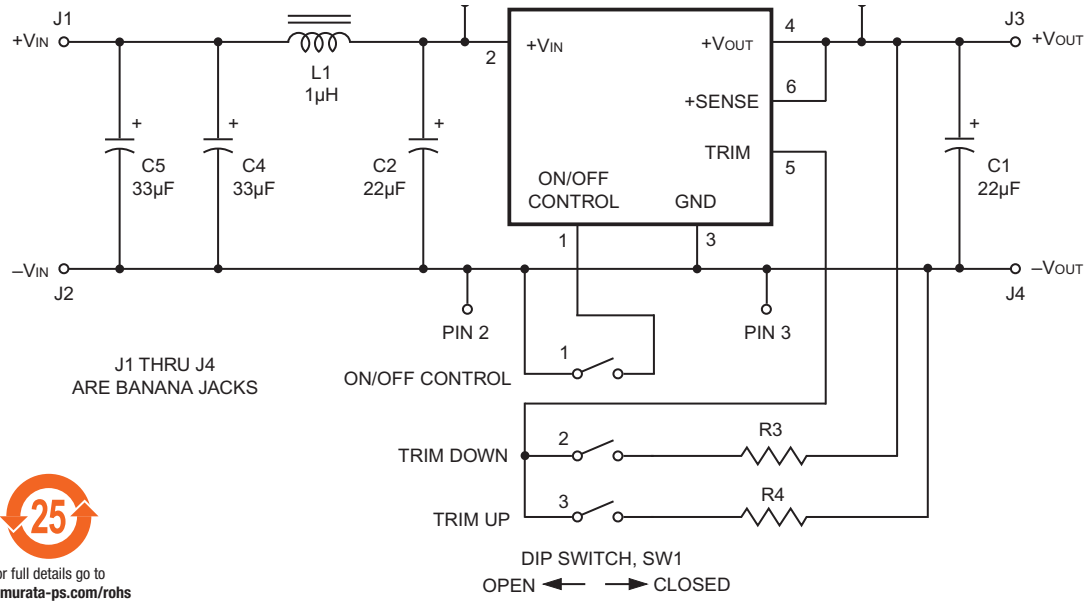
### Features

- **Rapid evaluation of DATEL LSM series 10 Amp DC/DC converters**
- **Twenty-four models ranging from 0.8V to 5V single outputs at 10 Amps max. Ideal for mixed logic families.**
- **For CPU, logic array and custom controller applications**
- **Avoids initial user development of SMT mounting systems while offering realistic evaluation of a surface-mounted converter**
- **Rugged banana jack I/O connections plus input Pi L-C filter**
- **Provision for external shut-down control inputs and trim circuit evaluation**
- **Includes test points for oscilloscope evaluation of performance**

Designed to ease the evaluation of today's subminiature surface-mount technology (SMT) 10 Amp single output DC/DC power converters, DATEL's LSM-EB series includes twenty four models for all popular logic family output voltages and common input power voltages. Each LSM-EB model consists of a 4.31-inch square circuit board including a DATEL LSM-series surface mounted DC/DC converter, input/output banana jacks, trim circuits and various passive components.

Rather than hand wiring to small mounting pads, the user can more accurately test real world electrical and thermal performance on a mounting board with a full ground plane and input Pi filter. The circuit board is mounted on four removable one-inch standoffs threaded for 4-40 screw attachment.

The heart of the LSM-EB evaluation board is DATEL's advanced single output non-isolated LSM series DC/DC converter. Running from either 3.3 Volt, 5 Volt or 12 Volt DC input power, the LSM series provides high quality point-of-load (POL) output power for CPU's, memory systems, microcontrollers and large array logic. See DATEL's LSM Series data sheet for full information.




RoHS COMPLIANT 2002/95/EC

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For full details go to
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| Specification Summary ① | |
|---|---|
| **DC/DC Converter type** | DATEL LSM series ① |
| **Input Voltage** | 3.3, 5 or 12 Volts (see Ordering Guide) |
| **Output Voltage** | 0.8 to 5 Volts, (see Ordering Guide) |
| **Output Current** | 10 Amps, max. |
| **Minimum load** | Zero (no minimum load) |
| **Input and Output Terminals** banana jacks (4 locations) | 0.166-inch (4.22mm) removable |
| **Outline Dimensions** | 4.31" x 4.31" x 1.5" max. (including standoffs) |
| **Height above board** | 0.41" |
| **Standoffs** ③ | Four removable, 1.0" length, 4-40 threaded |
| **Fabrication** | Multi-layer printed circuit board |
| **Operating Temp. Range** (Ambient, natural convection) | –40 to +65/+71°C ② |

① See DATEL's LSM series data sheet for full information on the DC/DC converter.
② Maximum operating temperature ranges are dependent on model type. See the LSM series converter data sheet. Temperature range may be extended with forced cooling.
③ The standoffs are not connected to the board ground plane. Use a discrete connection if you wish to ground the standoffs.

### Component Locations

The board is laid out with filter capacitors and the inductor on the input and a filter capacitor on the output. These represent typical values that you would normally use in your application therefore, performance should be similar. Also, the values comply with those recommended in the LSM data sheet.

The two trim resistor locations (R3 and R4) are left open for the user to install suitable trim resistors, either as axial lead resistors or "0805" surface mount resistors. White silkscreening on the board identifies all components.

### Usage Guidelines

Refer to the LSM series data sheet for full details on the following topics.

### Input/Output Connections

Holding the module upright, input power is applied to the left set of banana jacks. Output power is extracted from the right banana jacks. Please note that both ground terminals on the bottom are connected together internally. To retain high system performance, be sure to use the proper gauge wiring (12 gauge or larger is recommended). The hex standoffs are not connected to the ground plane.

Use as short wiring as possible. For longer power wiring, to prevent noise radiation, consider either twisting the leads and/or enclosing the leads in a grounded copper shield.

### Input Pi Filter

A classic Pi filter is provided on the converter's input. While this filter is not required if you can assure that the input voltage at the DC/DC terminals remains within the input voltage range at all times and is reasonably low noise, many applications will see improved performance if the filter is employed. The filter is also useful for switching output loads and for evaluation of input ripple current. The inductor and associated capacitors are selected to prevent saturation and excessive power dissipation at the full 10 Amp output current while avoiding inductive spike damage to the DC/DC. The capacitors are chosen for low ESR.

### Diagnostic Test Points

Four pins are provided for a combination of measurements. Pins 1 and 2 sense the voltage immediately at the DC/DC inputs. Pins 3 and 4 display the output voltage. Connect these pins either to an oscilloscope or voltmeter.

If preferred, the input inductor may be bypassed by shorting J1 to Pin 1.

### Input Current Measurement

A current sense resistor (not supplied) may be conveniently installed across the input inductor from J1 to Pin 1 after removing inductor L1 with a surface mount hot air desoldering tool. Suggested resistor values are 2 to 5 milliohms. These values will not degrade operation of the DC/DC converter yet will develop sufficient voltage at full power for measurement by a digital voltmeter or oscilloscope.

Note that the 'scope must be connected in differential mode. If preferred, a sense resistor can also be installed in series with either ground jack without having to remove L1. A sense resistor of several milliohms may be conveniently fabricated with several inches of 12 or 14 gauge wire.

### Digital On/Off Control

The top section (SW1-A) of the 3-pole DIP switch enables the power output of the converter. You may either do this manually with the rocker switch or connect an external logic gate to the pole nearest the output terminals on the back side of the board. Such an external gate should be referenced to the converter's power ground and use 5V TTL/LS logic.

A small reed relay or an open collector NPN transistor or FET may also be used to control the DC/DC with the collector tied to the same control terminal pole on the DIP switch. The converter's on/off control includes an internal pullup resistor to +5V. The pullup is 5 to 14 kilohms, depending on model. Leave the on-board DIP switch open if you use any of these external controls. Use short leads if you install an external control.

If the on/off control is left open, the converter will operate normally. Always make sure the DC/DC is powered up before activating the on/off control.

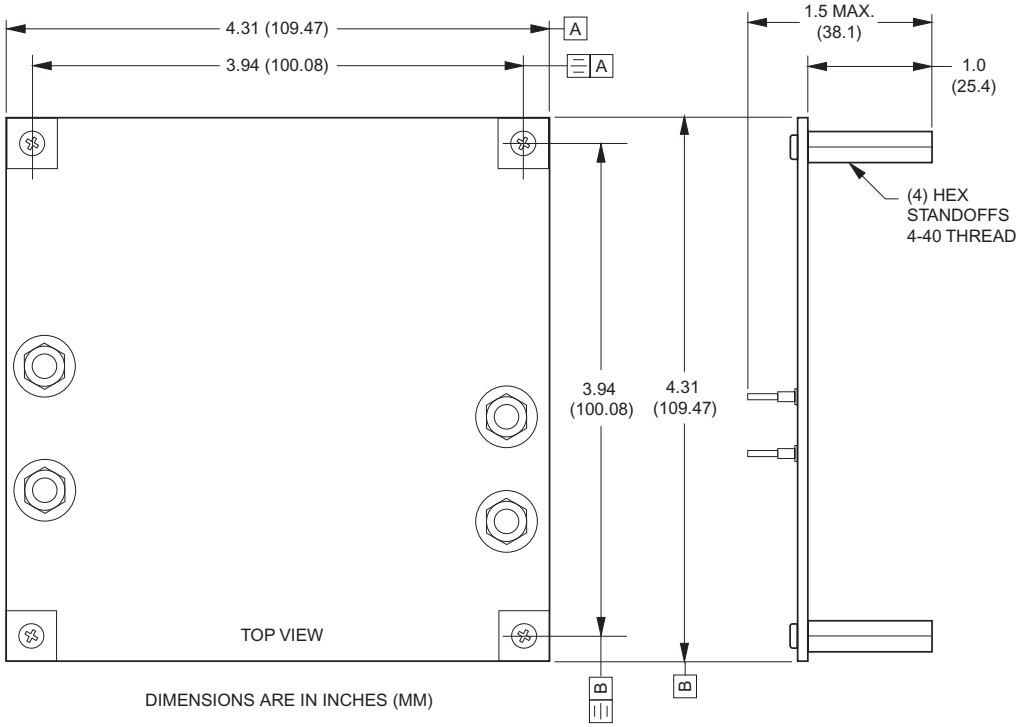
### Trim Circuits

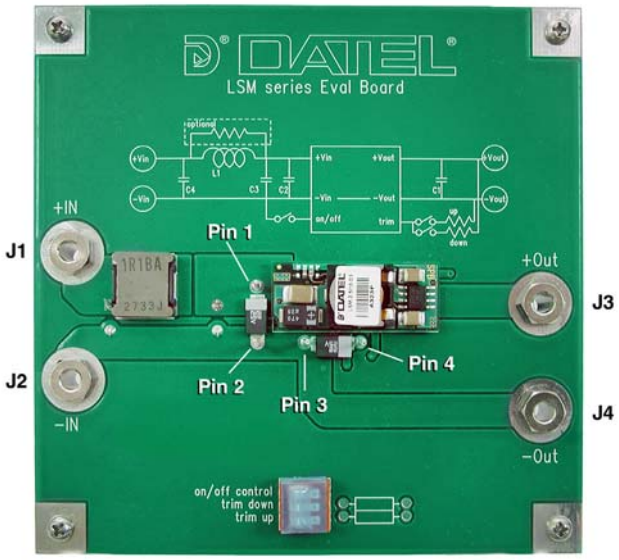
The bottom two sections of the 3-pole DIP switch connects the converter's single trim input to two external resistor positions immediately to the right of the switch body. See the schematic diagram. The upper resistor corresponds to the leg connecting to the +Vout terminal and the bottom resistor connects to –Vout. The switches allow you to temporarily disconnect the trim resistors to evaluate their effects.

You may either install discrete resistors in these two through-hole or surface mount locations or you may wire a closely-mounted 20 kilohm potentiometer between the board pads. Use short leads to prevent noise pickup and instability. Study the LSM data sheet for the required resistor values.

### Thermal Considerations

The DC/DC converter, when mounted on the evaluation board, is rated up to approximately +65 degrees Centrigrade operation (depending on model) using natural convection at low or moderate altitude. The converter is protected by thermal shutdown if overcurrent, higher altitude and/or overtemperature operation is attempted. Some heat is extracted through the mounting pads. Higher temperature operation is available with forced cooling. Carefully study the derating curves on the LSM data sheet.




| I/O Connections | |
|---|---|
| **Terminal** | **Function** |
| J1 | +VIN external |
| J2 | –VIN external |
| J3 | +VOUT external |
| J4 | –VOUT external |
| Pin 1 | DC/DC +VIN |
| Pin 2 | DC/DC –VIN |
| Pin 3 | DC/DC –VOUT |
| Pin 4 | DC/DC +VOUT |

**Distributed Bus Architecture**

The LSM series DC/DC converters are an ideal solution for modern intermediate bus architecture (IBA) or distributed bus architecture (DBA) applications used in telecommuncations and dedicated stand-alone systems. DBA's see implementation whenever multiple final power voltages are required (each using a dedicated single-voltage DC/DC converter) while retaining overall system power isolation.

DBA's position the final DC/DC right at the load (also called Point of Load, POL converters). This provides the best possible dynamic response, regulation, and noise reduction. It also distributes the thermal load to avoid system hotspots or concentrations of high switching currents. Since the POL DC/DC's are non-isolated models, their physical size is reduced, making them ideal for tape and reel automated surface mounting.

A single system-wide master high power bus converter performs the initial power voltage conversion. A 48Vdc input is typical with 12Vdc outputs distributed to several POL DC/DC's. DBA's also retain very high system efficiency, important for battery operated and standby applications.

In the diagram below, a DATEL model SBC-12/22-L48 acts as the bus converter from system 48 Volts to 12 Volts distributed to each POL converter. One POL converter powers 3.3V system logic while a separate 1.2V POL converter runs the CPU. A third 5V POL converter powers legacy I/O ports. Notice that the 12V power leads are routed all the way back to the the bus converter for best performance. Also observe that only one source of isolation is required (in the bus converter) so that individual POL converters can be lower cost non-isolated versions.

The Distributed Bus Architecture offers a lower overall system cost than using separate bulkier isolated converters at each voltage load. And it prevents possible crosstalk of high power digital switching signals. A final advantage of DBA's is that the designer has a choice of where and how to interconnect system grounds and is not restricted by a noisy system "mecca" ground.

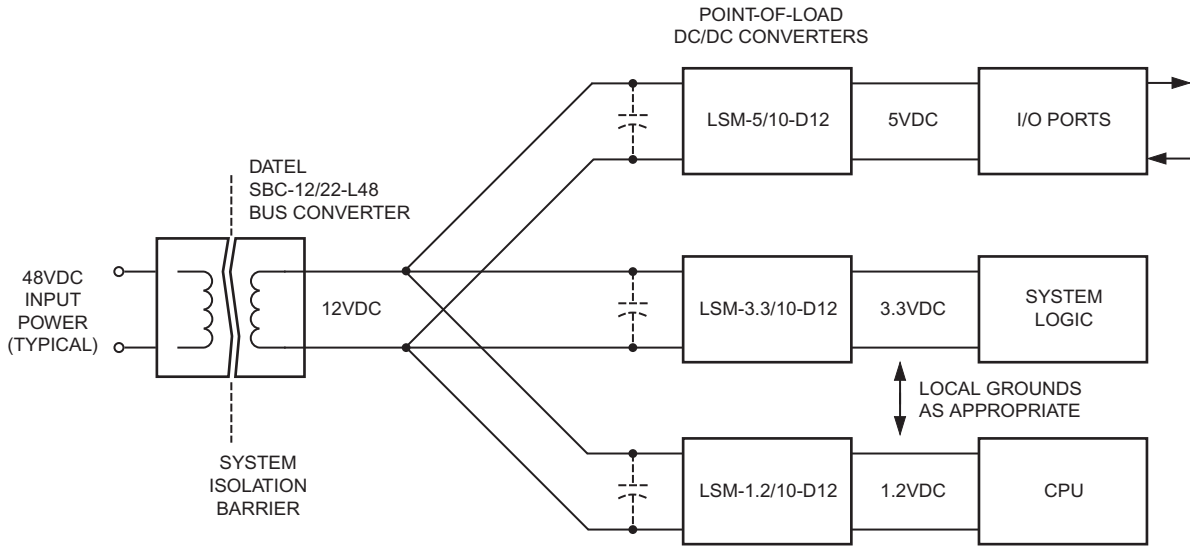



**Figure 2. Distributed Bus Architecture**

## Ordering Guide

All Evaluation Board models have 10 Amp maximum output current and use identical mounting and pad numbering. Three input voltages (3.3V, 5V and 12V) are offered. DATEL will review special or custom versions of other voltages for scheduled quantity applications.

| Model Number | DC Output Voltage | DC Input Range |
|---|---|---|
| **LSM-0.8/10-D3EB** | 0.8 Volts | 3 to 3.6 Volts |
| **LSM-0.8/10-D5EB** | 0.8 Volts | 4.5 to 5.5 Volts |
| **LSM-0.8/10-D12EB** | 0.8 Volts | 10 to 14 Volts |
| **LSM-1/10-D3EB** | 1.0 Volts | 3 to 3.6 Volts |
| **LSM-1/10-D5EB** | 1.0 Volts | 4.5 to 5.5 Volts |
| **LSM-1/10-D12EB** | 1.0 Volts | 10 to 14 Volts |
| **LSM-1.2/10-D3EB** | 1.2 Volts | 3 to 3.6 Volts |
| **LSM-1.2/10-D5EB** | 1.2 Volts | 4.5 to 5.5 Volts |
| **LSM-1.2/10-D12EB** | 1.2 Volts | 10 to 14 Volts |
| **LSM-1.5/10-D3EB** | 1.5 Volts | 3 to 3.6 Volts |
| **LSM-1.5/10-D5EB** | 1.5 Volts | 4.5 to 5.5 Volts |
| **LSM-1.5/10-D12EB** | 1.5 Volts | 10 to 14 Volts |

| Model Number | DC Output Voltage | DC Input Range |
|---|---|---|
| **LSM-1.8/10-D3EB** | 1.8 Volts | 3 to 3.6 Volts |
| **LSM-1.8/10-D5EB** | 1.8 Volts | 4.5 to 5.5 Volts |
| **LSM-1.8/10-D12EB** | 1.8 Volts | 10 to 14 Volts |
| **LSM-2/10-D3EB** | 2.0 Volts | 3 to 3.6 Volts |
| **LSM-2/10-D5EB** | 2.0 Volts | 4.5 to 5.5 Volts |
| **LSM-2/10-D12EB** | 2.0 Volts | 10 to 14 Volts |
| **LSM-2.5/10-D3EB** | 2.5 Volts | 3 to 3.6 Volts |
| **LSM-2.5/10-D5EB** | 2.5 Volts | 4.5 to 5.5 Volts |
| **LSM-2.5/10-D12EB** | 2.5 Volts | 10 to 14 Volts |
| **LSM-3.3/10-D5EB** | 3.3 Volts | 4.5 to 5.5 Volts |
| **LSM-3.3/10-D12EB** | 3.3 Volts | 10 to 14 Volts |
| **LSM-5/10-D12EB** | 5.0 Volts | 10 to 14 Volts |

Murata Power Solutions

Murata Power Solutions, Inc.
11 Cabot Boulevard, Mansfield, MA 02048-1151 U.S.A.
Tel: (508) 339-3000 (800) 233-2765 Fax: (508) 339-6356
**www.murata-ps.com email: sales@murata-ps.com ISO 9001 REGISTERED**



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**USA:** Mansfield (MA), Tel: (508) 339-3000, email: sales@murata-ps.com
**Canada:** Toronto, Tel: (866) 740-1232, email: toronto@murata-ps.com
**UK:** Milton Keynes, Tel: +44 (0)1908 615232, email: mk@murata-ps.com
**France:** Montigny Le Bretonneux, Tel: +33 (0)1 34 60 01 01, email: france@murata-ps.com
**Germany:** München, Tel: +49 (0)89-544334-0, email: munich@murata-ps.com
**Japan:** Tokyo, Tel: 3-3779-1031, email: sales_tokyo@murata-ps.com
Osaka, Tel: 6-6354-2025, email: sales_osaka@murata-ps.com
**Website: www.murata-ps.jp**
**China:** Shanghai, Tel: +86 215 027 3678, email: shanghai@murata-ps.com
Guangzhou, Tel: +86 208 221 8066, email: guangzhou@murata-ps.com