SM01C DC-DC Converter

Datasheet V1

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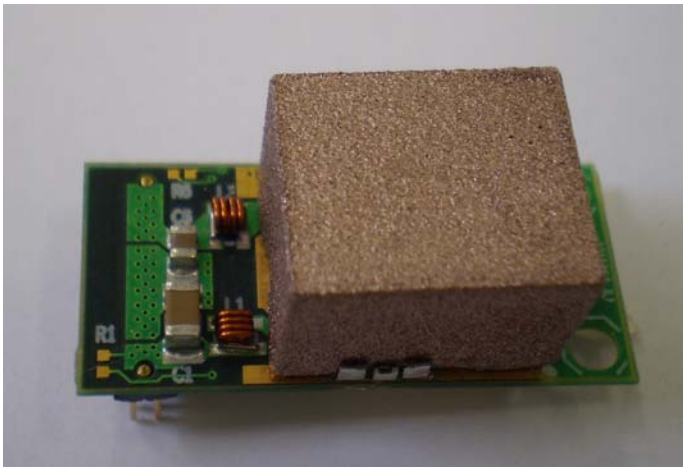
Main Features



The SM01C power converter is a pluggable power module based on the Linear Technology LTC3605 buck controller. Its design is optimized to operate from a 10V input voltage, delivering a regulated 2.5V output up to 5A output current. Its layout is optimized to achieve very low levels of conducted and radiated noise, making it compatible for the powering of highly sensitive front-end electronics in physics experiments. The use of non ferromagnetic materials makes it suitable for operation in presence of strong DC magnetic fields. A cooling thermal pad is provided for conductive cooling. The converter is fitted with a 32 pins high density Samtec connector used as input and output power board interface; it integrates also enable and monitoring lines.

Non isolated DC to DC synchronous buck converter.
Wide input voltage range: 7V to 15V.
Fixed 2.5V output voltage.
High switching frequency: 2 MHz.
Output current up to 5A.
High efficiency, typically 85% at 2A output current.
Very low conducted and radiated noise.
Compatible for operation in high DC magnetic fields.
Thermal interface for optimal conduction cooling.
Enable function input pin.
Power good monitoring pin.
Compact design.

Functional Diagram

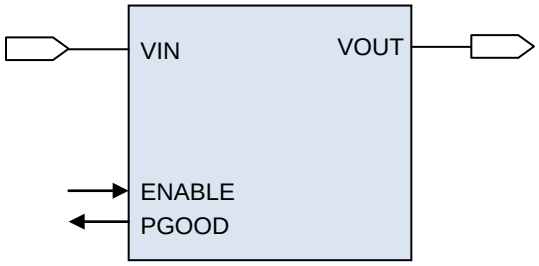


Figure 1: block diagram

Power Interface

The power interface is provided at the bottom side of the module through a high density 2x16 pins Samtec connector, male type FTE-116-03-G-DV-A. The mating connector to be mounted on the receiving board is female type CLE-116-03-G-DV-A from Samtec.

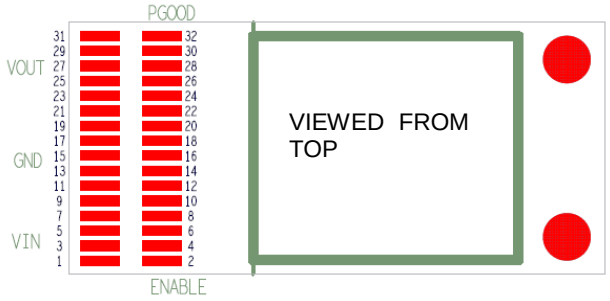


Figure 2: Top view and pin numbering of the power interface

Pin Number	Net
1,3,4,5,6	VIN
21,22,23,24,25,26,27, 28,29,30,31	VOUT
7,8,9,10,11,12,13,14, 15,16,17,18,19,20	GND
32	PGOOD
2	ENABLE

The ground pins are common for the input and output power ports and they must be directly tied to the ground plane of the receiving board. It must be noticed that these pins carry the full output current and therefore connections to ground planes must be done through via arrays for adequate current sharing. The same rules must be followed for the connection of the input voltage and output voltage nodes. Full contacting SMD pads are preferred over thermal relief contacts.

Enabling the converter

The ENABLE input allows controlling the converter operation. To enable to DCDC converter, this pin must be externally pulled above 1.2V, and up to the input voltage VIN. Tying this pin to ground (or below 1.1V) will turn off the converter.

To permanently enable to converter, a 10K resistor must be mounted at R1.

Monitoring pin

The PGOOD pin reflects the status of the converter. It is internally pulled up to the 3.3V output of the controller internal regulator. If the output is properly regulated within a 10% margin, this output is pulled up to 3.3V. Under faulty operation, this output is pulled to ground.

Efficiency properties

The efficiency is optimized for an output current of 2A, with typical values around 85% for voltages ranging between 7V and 12V. At the maximum output current the efficiency drops to 75%.

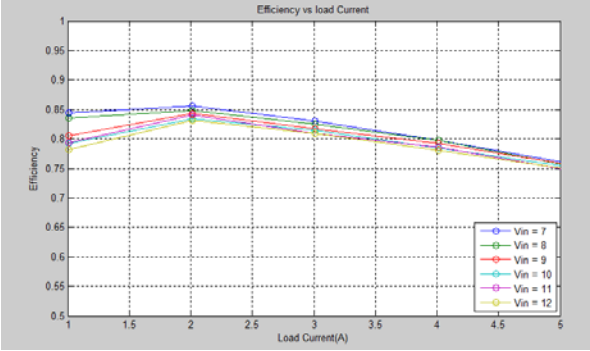


Figure 3: typical efficiency properties

Load regulation

The output voltage is set to 2.5V at 1A output current. The internal output resistance of the converter filter is around 25 mΩ, and the output voltage drops linearly to 2.4V at the maximum output current of 5A.

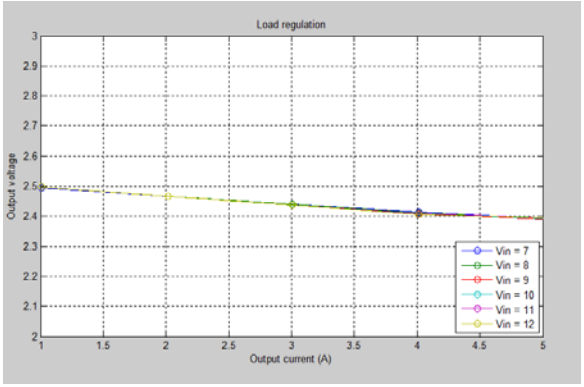


Figure 4: typical load regulation properties.

Noise properties

The noise properties are measured with a conducted noise measurement test stand with 10V input and 1A output current.

The output common mode current (Figure 5) is kept below the Class B limit of the CISPR11 reference standard, and it falls below 0 dBµA above 7 MHz.

The output differential mode current (Figure 6) is kept below the Class B limit of the CISPR11 reference standard, and it falls below -10 dBµA above 7 MHz.

These noise properties are obtained with the shield mounted on the converter. In this configuration, the residual electric field radiated by the converter is not measurable. Low levels of residual magnetic field are radiated, with amplitudes that are function of the shielding thickness.

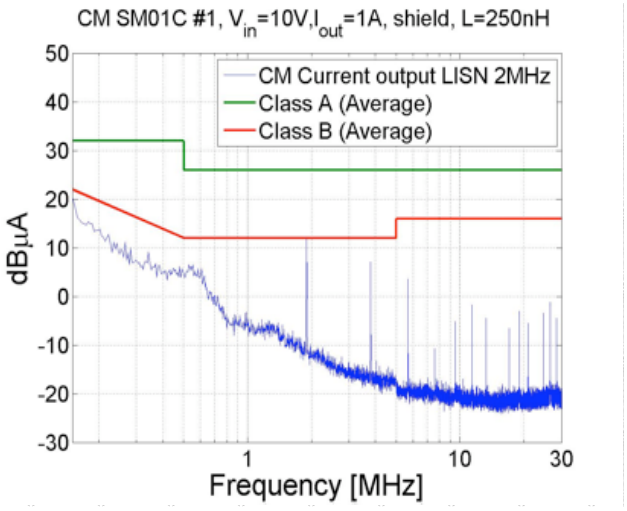


Figure 5: typical output common mode current.

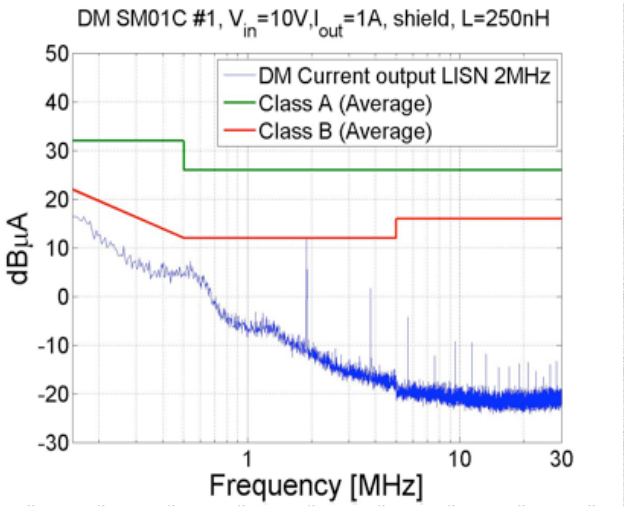


Figure 6: typical output differential mode current.

Top side board dimensions

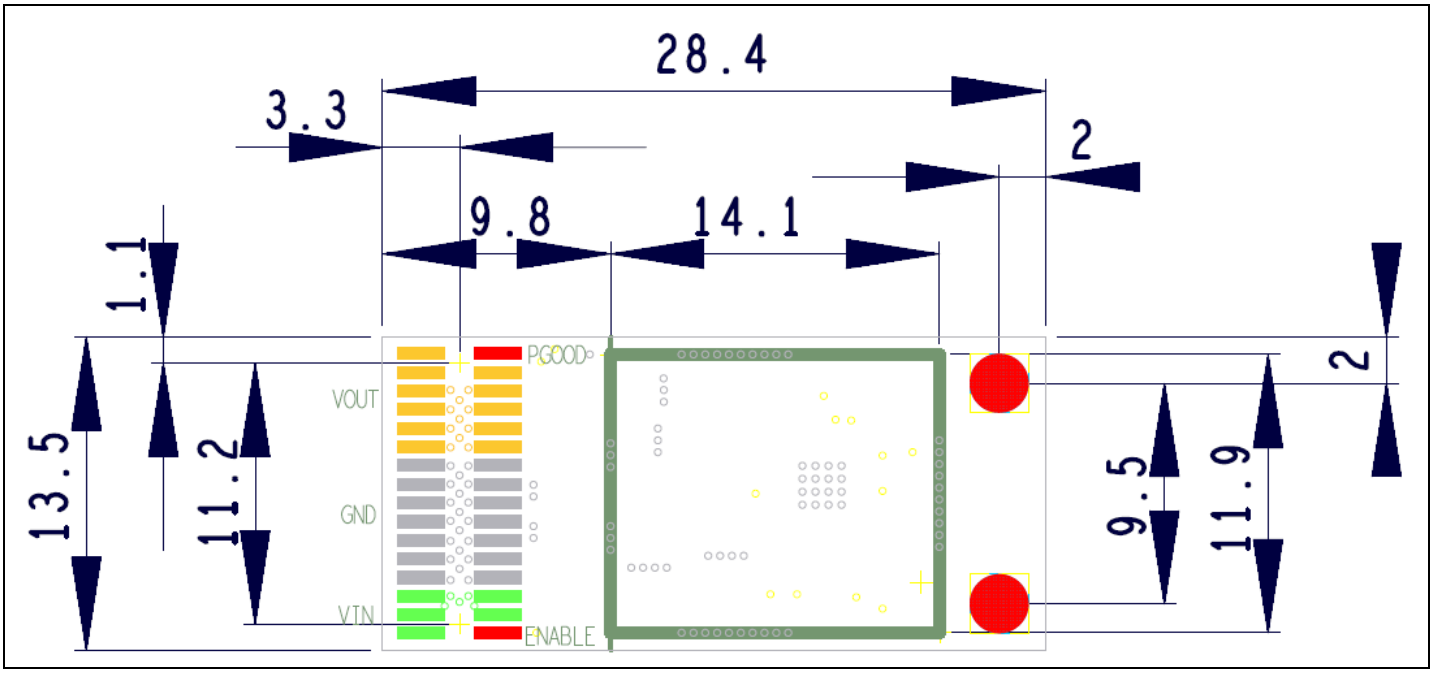


Figure 7: top view dimensions.

The DCDC module is 28.4mm x 13.5mm (Figure 7). A thermal interface for conductive cooling is provided in its bottom side, in direct contact with the thermal pad of the LT3605 through thermal vias. Two holes allow using two screws of 2.5mm in diameter to fix mechanically the module.

The shield box is hold by means of three grounding clips, the box is 10 mm high and it covers an area of 14.1 mm x 11.9 mm.

Recommended footprint

The mating connector to be mounted on the receiving board is female type CLE-116-03-G-DV-A from Samtec. The connector is provided with two alignment pins that fit on the receiving board in two corresponding unplated holes.

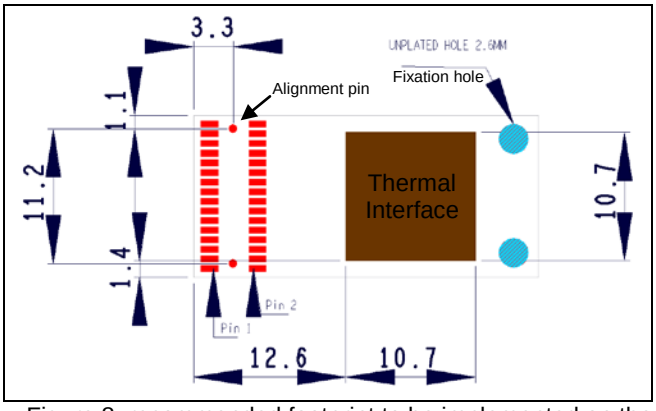


Figure 8: recommended footprint to be implemented on the receiving board.

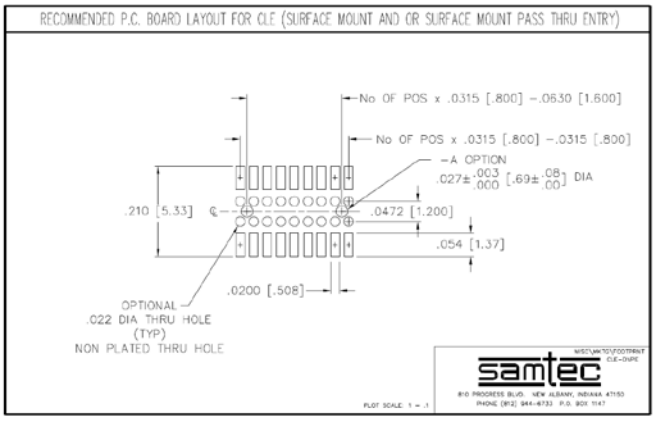


Figure 9: recommended footprint for the Samtec connector of the receiving board.

Thermal interface.

The module is provided on its bottom side with a thermal interface of 10.7 mm x 10.7 mm (Figure 8). For the adequate operation of the module, this interface must be attached to a cooling element but electrically isolated from it. For this, an electrically insulating thermal pad must be inserted between the DCDC module and the receiving board (for instance the Bregquist Gap Pad 30S3000, Farnell code 878-3527).

It must be noted also that the separation between the thermal interface of the DCDC and the one of the receiving board is equal; to the height of the two mated connectors, which is of 5 mm. A mechanical thermal conductive interface must be provided, such as a plain copper block.