UM0613
User manual

Dual DC-DC converter for powering an AMOLED display based on the STOD02

Introduction

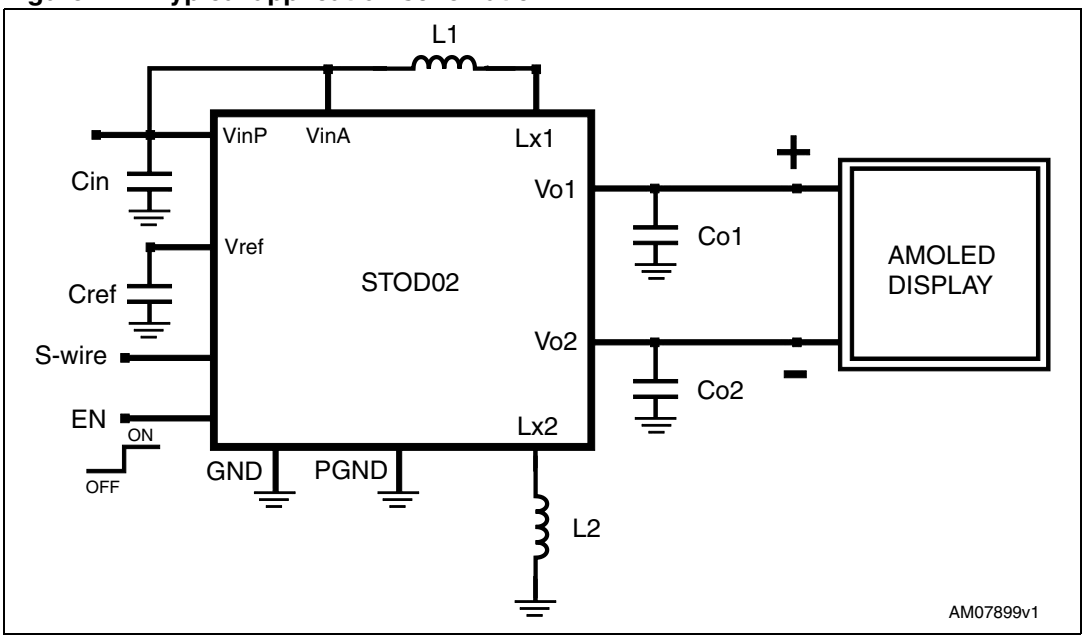
The STOD02 demonstration board is dedicated to showing the performance of the STOD02 dual DC-DC device, which is used to power AMOLED displays up to 3.0" with an input voltage range from 2.5 to 4.5 V.

It integrates a step-up and inverting DC-DC converter, able to deliver the positive and negative voltages needed for the AMOLED panel to operate. Due to the high switching frequency and to the full integration of the synchronous switches, the STOD02 needs very few and small external components, therefore reducing the BOM cost and the PCB area.

At the same time, this small size solution does not penalize the overall performance: efficiency stays above 85 % in the most used range of output current and input voltage while very good line and load transients allow the maintaining of a stable output voltage when the input voltage changes rapidly due to series resistance of the battery.

The STOD02 works in pulse-skipping mode during low load condition and in PWM mode (at 1.6 MHz) for medium/high load conditions. The Enable pin allows the turning off of the device, therefore reducing the current consumption to less that 1 µA. The negative output voltage can be programmed by an MCU through a dedicated pin which implements S-wire protocol. Soft-start with controlled inrush current limit and thermal shutdown are integrated functions of the device.

Figure 1. Typical application schematic



Contents

1 Package description and order codes

The dual DC-DC converter STOD02 is housed in a 12-pin DFN (3 x 3 mm.). The device is available in 2 different thicknesses: 0.8 mm and 0.6 mm. *Table 1.* shows the related commercial order codes.

Table 1. Order codes

Order code	Package	Packaging	Marking
STOD02PUR	DFN12L (3 x 3 x 0.8 mm)	3000 parts per reel	D02D
STOD02TPUR	DFN12L (3 x 3 x 0.6 mm)	3000 parts per reel	02T

2 External component selection

2.1 Input and output capacitor selection

The use of ceramic capacitors with low ESR as input and output capacitors is recommended. It is also recommended to use 4.7 µF / 6.3 V as a minimum value for the input and output capacitors and 1 µF / 6.3 V as the optimal value for the reference capacitor, in order to achieve good device stability.

Note: See recommended components in Table 2.

2.2 Inductor selection

In order to fully benefit from the compact solution offered by the STOD02, a very thin inductor with a low DC series winding resistance is recommended for this application.

The maximum current of the inductor must be taken into consideration in order to avoid saturation of the core. The STOD02 automatically limits the maximum current in the inductor to 0.9 A for the step-up stage and 1.1 A for the inverting stage.

Suggested inductance values are in the range between 4.7 µH and 6.8 µH.

Note: See recommended components in Table 2.

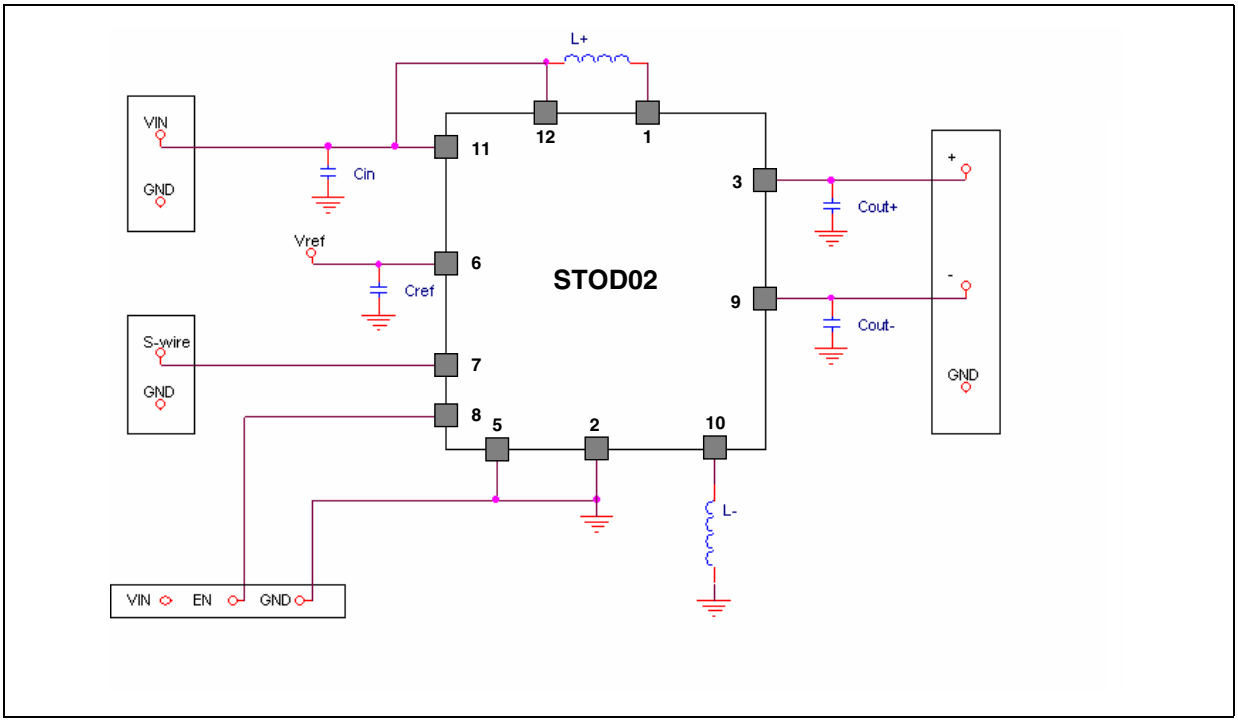
3 Demonstration board BOM and schematic

Table 2 shows the components used in the STOD02 demonstration board, however the STOD02 operation is not limited to the use of these components.

Table 2. BOM list

Component	Manufacturer	Part number	Value	Size
L+	MARUWA	CXFU 0208 – 4R7	4.7 µH	3.3 x 3.3 x 0.8 mm
L-	MARUWA	CXFU 0208 – 4R7	4.7 µH	3.3 x 3.3 x 0.8 mm
C_{IN}	MURATA	GRM188R60J475KE19	4.7 µF	0603
C_{OUT+}	MURATA	GRM188R60J475KE19	4.7 µF	0603
C_{OUT-}	MURATA	GRM188R60J475KE19	4.7 µF	0603
C_{ref}	MURATA	GRM188F51A105ZA01	1.0 µF	0402

Figure 2. Demonstration board schematic



4 Connector description

Table 3. Connector description

Connector	Function	Notes
Input	Power input voltage	This is the input power source. The STOD02 is specifically designed to work with low impedance power sources, such as a battery. In the case where a lab power source is used with long wires, a 470 µF capacitor connected to the input connector must be used to bypass the power input source.
Output	Positive and negative outputs	The positive and negative voltages are available through this connector. The cumulative differential voltage is supplied between + and – connectors. A real AMOLED panel must be connected between them. The single positive and negative voltages are supplied at +/GND and -/GND for testing purposes.
S-wire	Connection for S-wire pin	This connector allows access to the S-wire pin. The negative voltage of the STOD02 is set at - 4.9 V as a default. By applying a special command to the S-wire pin the negative voltage can be changed to different values. See the STOD02 datasheet for a detailed description of this function. Short the S-wire pin to GND if this function is not used.
Enable	Connection for Enable pin	This connector allows the turning-on/off of the device. A short between En/V_{IN} enables the device, while a short between En/Gnd disables the device.

5 PCB layout

The STOD02 is a switching device in which the PCB must be designed in line with switched supplies design rules. The power tracks (or wires in the demo board) must be as short as possible and of suitable width, because of the peak currents involved. It is recommended to use a 2-layer PCB to attain the best performance. All external components must be placed as close as possible to the STOD02. All high-energy switched loops should be as small as possible to reduce EMI. Efficient cooling is needed and may be done by using a dedicated copper area on the PCB.

All the Power ground tracks coming from C_{IN}, C_{OUT+}, C_{OUT-} must be placed as close as possible to the PGND pin in order to create a good GND route.

5.1 Demonstration board PCB layout

Figure 3. Top layer

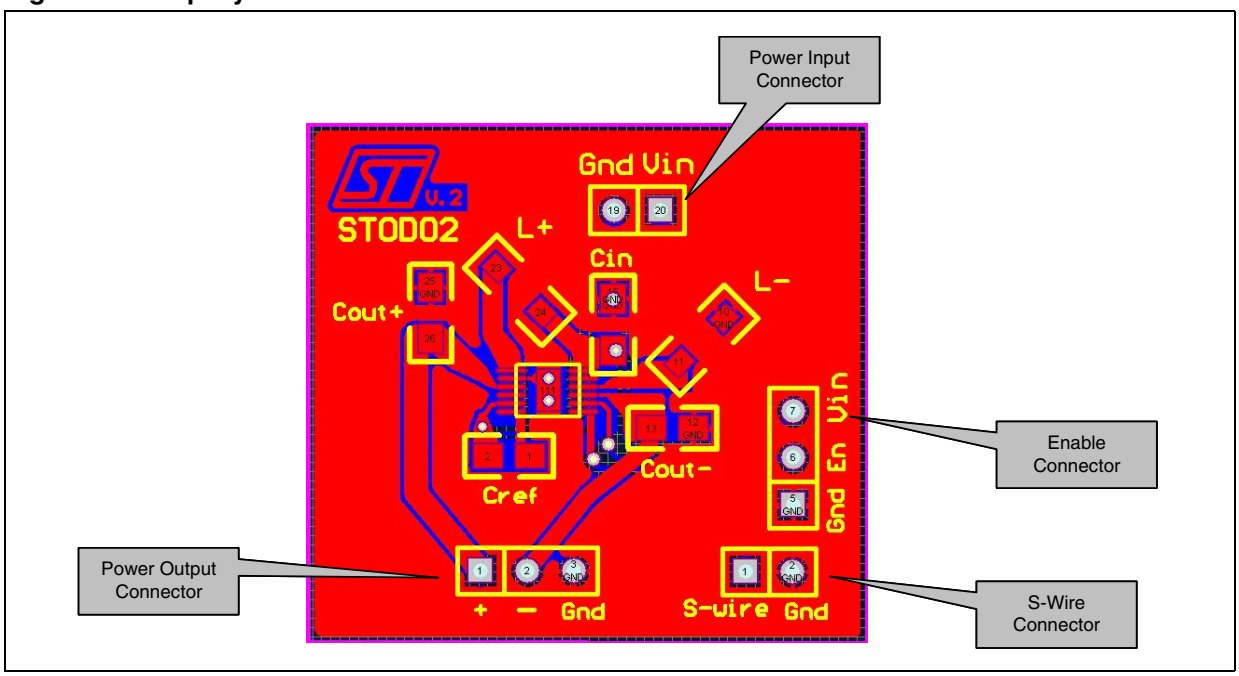
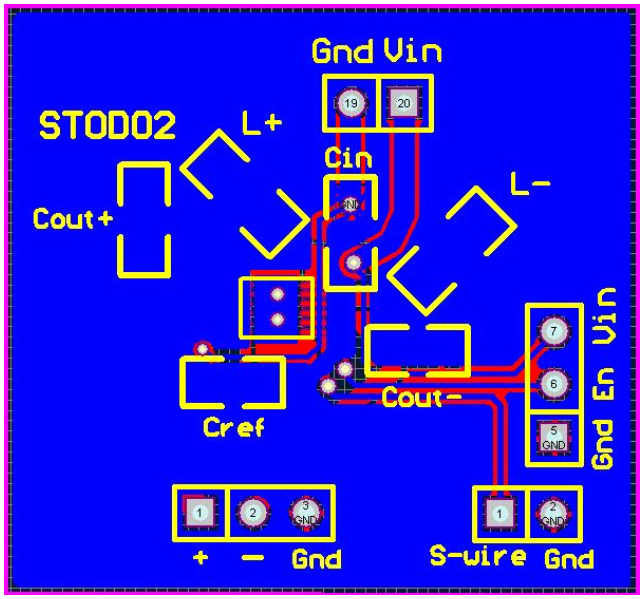


Figure 4. Bottom layer



6 Efficiency results

External components as per *Table 2*

Figure 5. Efficiency vs. I_{OUT}

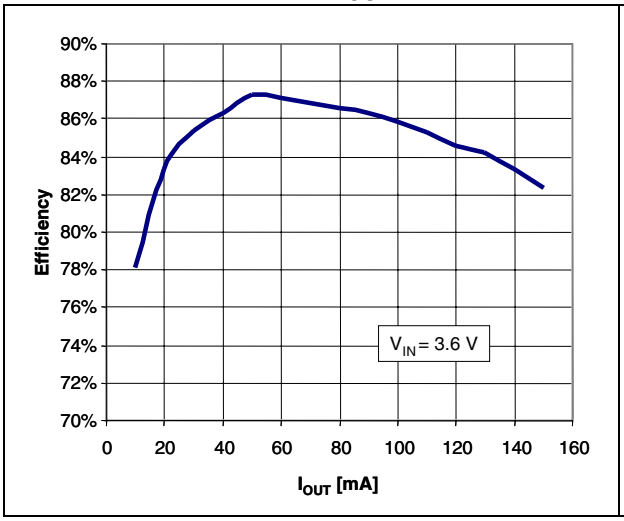
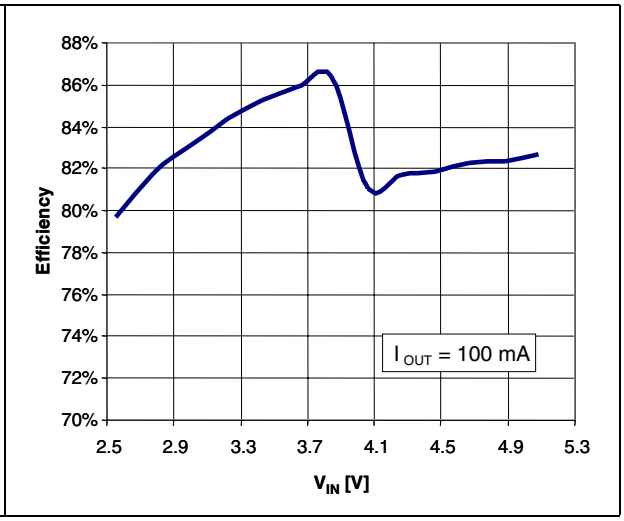


Figure 6. Efficiency vs. V_{IN}



7 Revision history

Table 4. Document revision history

Date	Revision	Changes
30-Nov-2010	1	Initial release.

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