

LTM8002 40V_{IN}, 2.5A Step-Down μModule Regulator

DESCRIPTION

Demonstration circuit 2501A features the **LTM®8002**, a 40V, 2.5A step-down μModule® regulator. This demo circuit is configured to deliver a 5.0V output from an input voltage between 6.0V to 40V at a switching frequency of 1MHz. The wide input range of the LTM8002 allows a variety of input sources such as automotive batteries and industrial supplies. Under light load conditions, the available Burst Mode® operation supports high efficiency with low output ripple.

The demo board has an EMI filter installed. The EMI performance of the board is shown in Figure 6 and Figure 7.

The LTM8002 data sheet gives complete description of the device, operation and application information. The data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit 2501A.

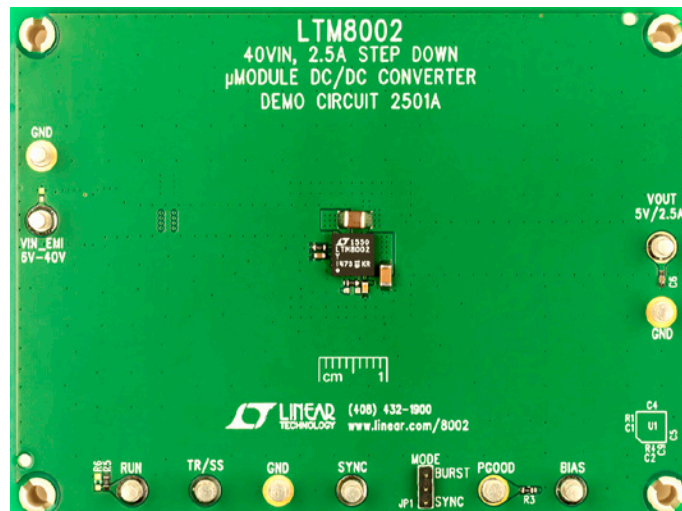
Design files for this circuit board are available at <http://www.linear.com/demo/DC2501A>

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PERFORMANCE SUMMARY Specifications are at T_A = 25°C

| SYMBOL | PARAMETER | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------------------|---------------------|--|------|------|------|-------|
| V _{IN} | Input Supply Range | | 6 | | 40 | V |
| V _{OUT} | Output Voltage | | 4.75 | 5 | 5.25 | V |
| I _{OUT} | Output Current | V _{IN} = 12V | 2.5 | | | A |
| f _{SW} | Switching Frequency | V _{IN} = 12V, I _{OUT} = 2.5A | | 1 | | MHz |
| V _{OUT} (AC) | Output Ripple (BW) | V _{IN} = 12V, I _{OUT} = 2.5A | | 30 | | mV |
| η | Efficiency | V _{IN} = 12V, I _{OUT} = 2.5A | | 90.7 | | % |

BOARD PHOTO



QUICK START PROCEDURE

Demo circuit 2501A is an easy way to evaluate the performance of the LTM8002. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

Note. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the V_{INEMI} or V_{OUT} and GND terminals. See Figure 2 for proper scope probe technique.

1. Place JP1 in Burst position.
2. With power off, connect the input power supply to V_{IN_EMI} and GND.
3. Turn on the power at the input.

Note. Make sure that the input voltage does not exceed 40V.

4. Check for the proper output voltage between V_{OUT} and GND ($V_{OUT} = 5V$).

Note. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

5. Once the proper output voltage is established, adjust the load within the operating range and measure the output voltage regulation, ripple voltage, efficiency and other parameters.
6. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Make sure that R1 be chosen to set the switching frequency equal to or below the lowest SYNC frequency. JP1 can also set the regulator in pulse-skipping mode (Floating JP1) or spread spectrum mode (JP1 on SYNC, and set it high between 3.2V and 4.2V).

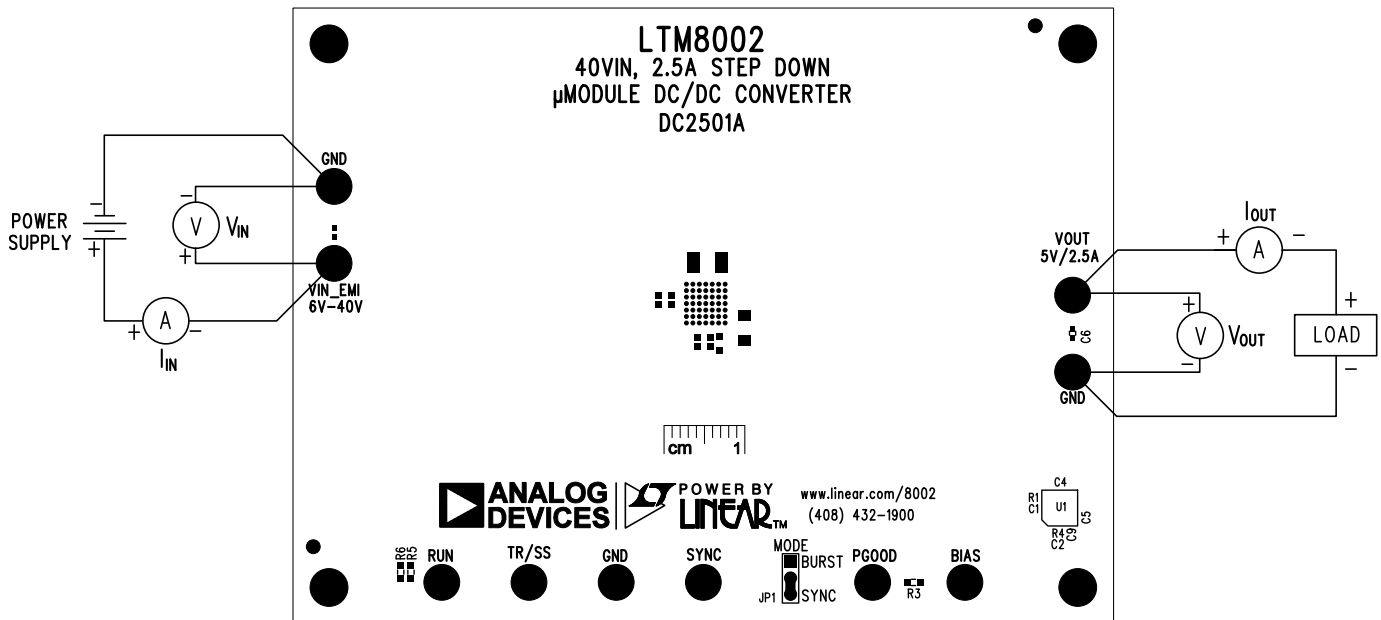


Figure 1. DC2501A Proper Equipment Setup

QUICK START PROCEDURE

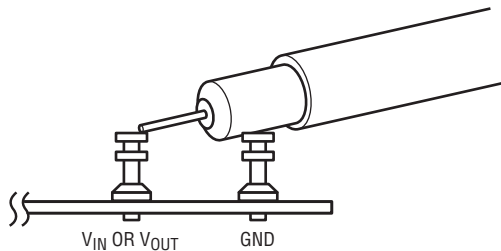


Figure 2. Measuring Input or Output Ripple

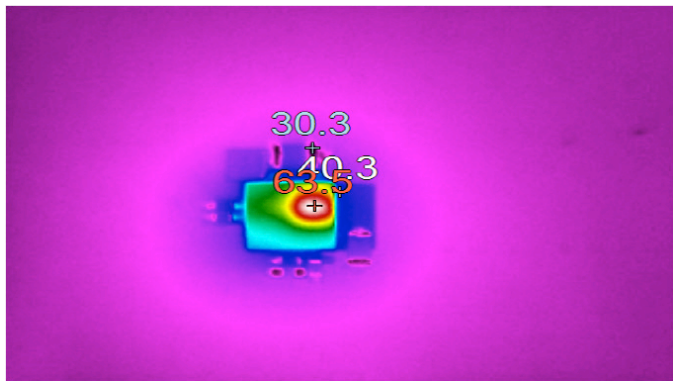


Figure 3. DC2501A Thermal Performance (12V_{IN}, I_{OUT} = 2.5A, T_A = 25°C)

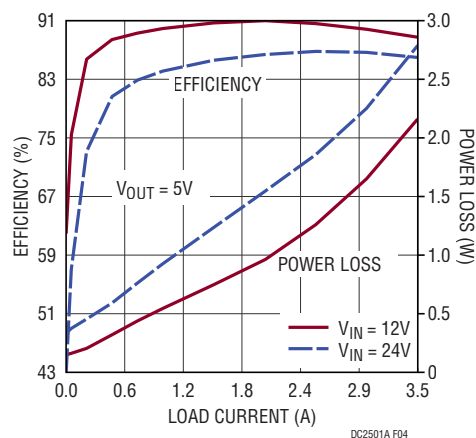


Figure 4. DC2501A Efficiency vs Load Current (T_A = 25°C)

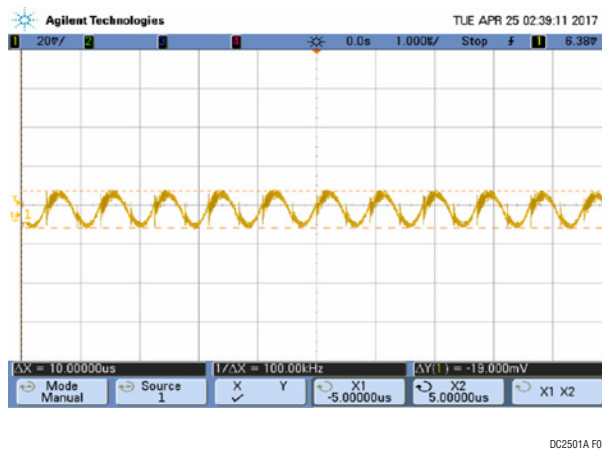
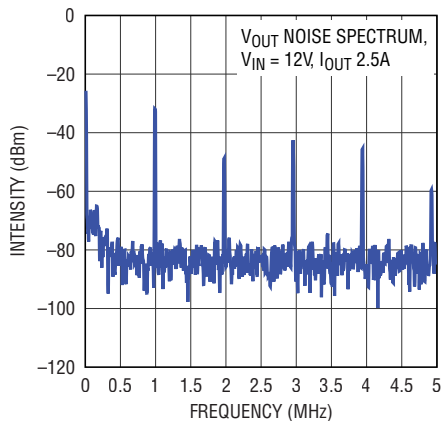


Figure 5. Output Noise with Load Current 2.5A, V_{IN} = 12V

QUICK START PROCEDURE

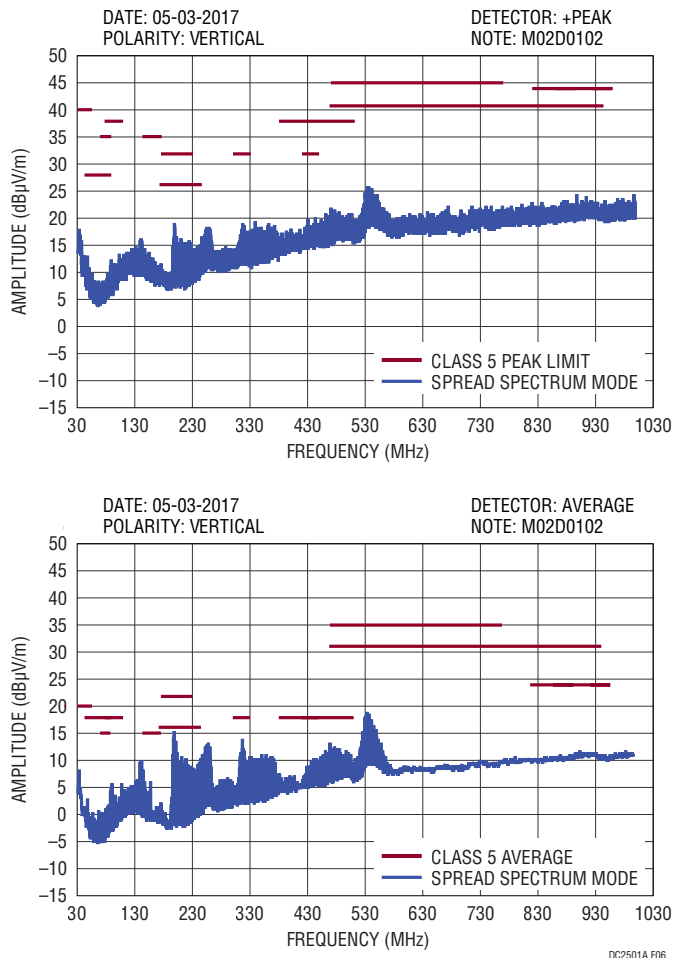


Figure 6. Radiated Peak and Average EMI – 30MHz to 1GHz. Condition: $I_{OUT} = 2.5A$, $V_{IN} = 14V$, $f_{SW} = 1MHz$

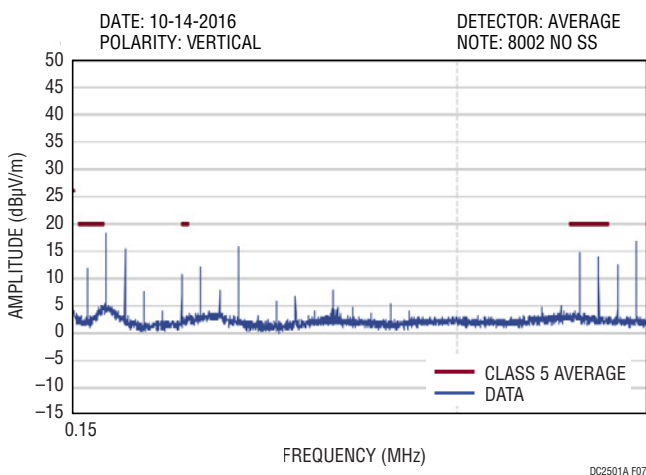


Figure 7. Radiated Average EMI Below 30MHz. Condition: $I_{OUT} = 2.5A$, $V_{IN} = 14V$, $f_{SW} = 1MHz$

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---|-----|--------------------|--|-------------------------------------|
| Required Circuit Components | | | | |
| 1 | 1 | C1 | CAP., X7R, 0.1 μ F, 25V, 10% 0603 | MURATA, GRM188R71E104KA01D |
| 2 | 1 | C3 | CAP., ALUM., 15 μ F, 50V | SUNCON ELEC., 50HVT15MT |
| 3 | 2 | C4, C8 | CAP., X7R, 10 μ F, 50V, 10% 1210 | MURATA, GRM32ER71H106KA12L |
| 4 | 1 | C5 | CAP., X7S, 22 μ F, 6.3V, 20% 1206 | MURATA, GRM31CR70J226KE19L |
| 5 | 1 | C6 | CAP., X5R, 10 μ F, 6.3V, 20% 0402 | MURATA, GRM155R60J106ME44D |
| 6 | 1 | C7 | CAP., X7R, 4.7 μ F, 50V, 10% 1206 | MURATA, GRM31CR71H475KA12L |
| 7 | 1 | C9 | CAP., X7R, 1 μ F, 25V, 10% 0603 | MURATA, GRM188R71E105KA12D |
| 8 | 2 | C10 | CAP., X7R, 0.1 μ F, 50V, 10% 0402 | MURATA, GRM155R71H104KE14D |
| 9 | 1 | FB1 | FERRITE CHIP 30 Ω 6A 0805 | TDK, MPZ2012S300AT000 |
| 10 | 1 | R1 | RES., CHIP, 41.2k, 1/10W, 1% 0603 | VISHAY, CRCW060341K2FKEA |
| 11 | 2 | R3, R5 | RES., CHIP, 100k, 1/10W, 1% 0603 | VISHAY, CRCW0603100KFKEA |
| 12 | 1 | R4 | RES., CHIP, 24.3k, 1/10W, 1% 0603 | VISHAY, CRCW060324K3FKEA |
| 13 | 1 | R7 | FIXED IND 470NH 2.25A 87 M Ω , 0805 | WURTH ELEKTRONIK, 744383220047 |
| 14 | 1 | U1 | I.C., BGA, LTM8002, 49-PIN | ANALOG DEVICES, INC., LTM8002HY#PBF |
| Additional Demo Board Circuit Components | | | | |
| 1 | 0 | C2, C11, C12 (OPT) | CAP., 0603 | |
| 2 | 0 | R6 (OPT) | RES., 0603 | |
| Hardware for Demo Board Only | | | | |
| 1 | 10 | E1-E11 | TESTPOINT, TURRET, 0.094" PBF | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2 | 1 | JP1 | HEADER 3-PIN 0.079 SINGLE ROW | WURTH ELEKTRONIK, 62000311121 |
| 3 | 1 | XJP1 | SHUNT, 0.079" CENTER | WURTH ELEKTRONIK, 60800213421 |
| 4 | 4 | MH1-MH4 | STAND-OFF, NYLON 0.50" | WURTH ELEKTRONIK, 702935000 |



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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