

## LT8606 42V, 0.35A Micropower Synchronous Step-Down Regulator

### DESCRIPTION

Demonstration Circuit 2564A is a 42V, 0.35A micropower synchronous step-down regulator featuring the [LT<sup>®</sup>8606](#). The demo board is designed for 5V output from a 5.5V to 42V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The LT8606 is a compact, high efficiency, high speed synchronous monolithic step-down switching regulator that consumes less than 3 $\mu$ A of quiescent current when output is regulated at 5V. Top and bottom power switches, compensation components and other necessary circuits are inside of the LT8606 to minimize external components and simplify design.

The SYNC pin on the demo board is grounded by default for low ripple Burst Mode<sup>®</sup> operation. Move JP1 to PULSE SKIPPING position can change the operation mode to pulse-skipping operation. Once JP1 is on SPREAD SPECTRUM position, VCC is applied to the SYNC pin for low EMI spread spectrum operation. To synchronous to an external clock, move JP1 to SYNC and apply the external

clock to the SYNC turret. Figure 1 shows the efficiency of the circuit.

The demo board has an EMI filter installed. The radiated EMI performances of the board (with EMI filter) are shown in Figures 2 and 3. The red/green lines in Figures 2 and 3 are CISPR25 Class 5 peak/average limit. To use the EMI filter, the input should be tied to VEMI, not VIN. An inductor L2, which is a 0 $\Omega$  jumper on the board by default now, can be added in the EMI filter to further reduce the conducted emission.

The LT8606 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual for DC2564A.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2564A>**

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### PERFORMANCE SUMMARY

Specifications are at T<sub>A</sub> = 25°C

| SYMBOL           | PARAMETER              | CONDITIONS                                      | MIN  | TYP  | MAX  | UNITS |
|------------------|------------------------|-------------------------------------------------|------|------|------|-------|
| V <sub>IN</sub>  | Input Voltage Range    |                                                 | 5.5  |      | 42   | V     |
| V <sub>OUT</sub> | Output Voltage         |                                                 | 4.8  | 5    | 5.2  | V     |
| I <sub>OUT</sub> | Maximum Output Current |                                                 | 0.35 |      |      | A     |
| f <sub>SW</sub>  | Switching Frequency    |                                                 | 1.85 | 2    | 2.15 | MHz   |
| EFE              | Efficiency at DC       | V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 0.35A |      | 92.1 |      | %     |

## QUICK START PROCEDURE

DC2564A is easy to set up to evaluate the performance of the LT8606. Refer to Figure 4 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. See Figure 5 for the proper scope technique.

1. Set an input power supply that is capable of 42V/0.35A. Then turn off the supply.

2. With power off, connect the supply to the input terminals  $V_{IN}$  and GND.

3. Turn on the power at the input.

NOTE: Make sure that the input voltage never exceeds 42V.

4. Check for the proper output voltage of 5V. Turn off the power at the input.

5. Once the proper output voltage is established, connect a variable load capable of sinking 0.35A at 5V to the output terminals  $V_{OUT}$  and GND. Set the current for 0A.

a. If efficiency measurements are desired, an ammeter can be put in series with the output load in order to measure the DC2564A's output current.

b. A voltmeter can be placed across the output terminals in order to get an accurate output voltage measurement.

6. Turn on the power at the input.

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

7. Once the proper output voltage is established again, adjust the load and/or input within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other desired parameters.

8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Please ensure that the chosen RT sets the LT8606 switching frequency to equal or below the lowest SYNC frequency. See the data sheet section, Synchronization.

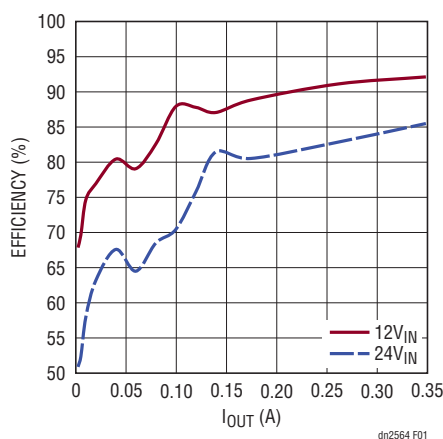


Figure 1. Efficiency vs Load Current at 2MHz Switching Frequency

## QUICK START PROCEDURE

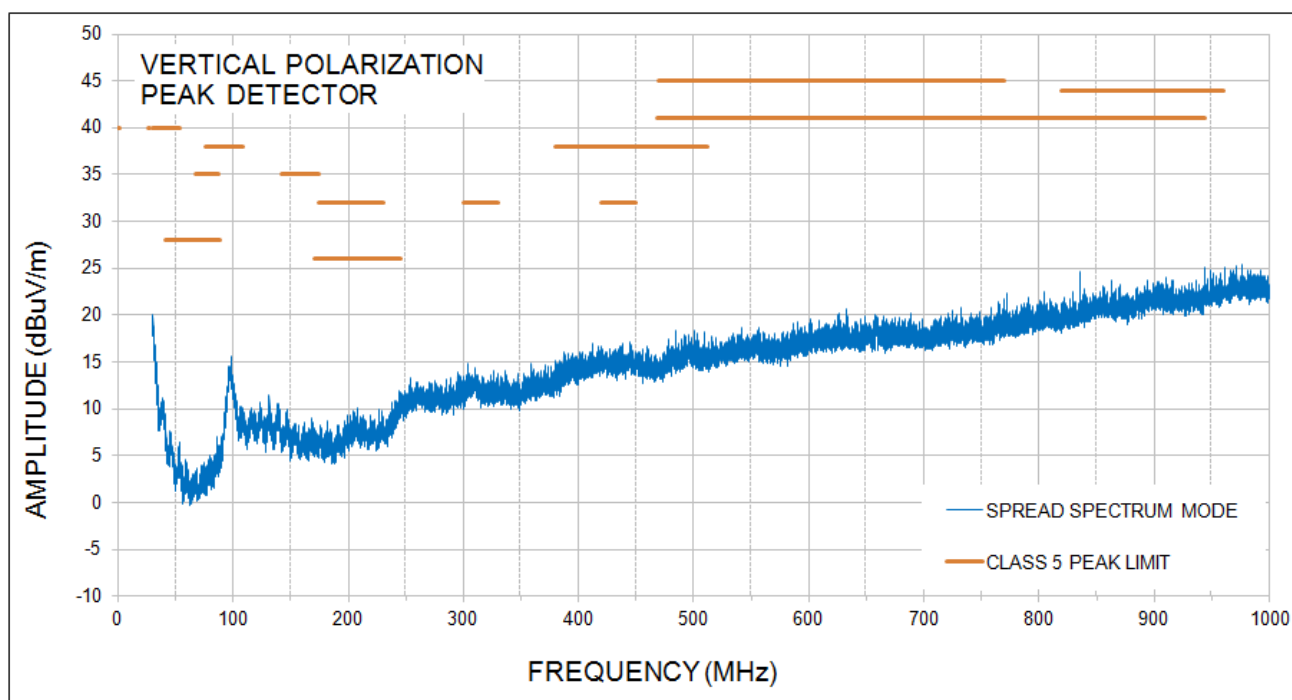


Figure 2. LT8606 Demo Circuit EMI Performance in CISPR25 Radiated Emission Test, Antenna Polarization: Vertical, Peak Detector ( $V_{IN} = 14V$ ,  $V_{OUT} = 5V$ ,  $I_{OUT} = 0.35A$ , 2MHz Switching Frequency)

## QUICK START PROCEDURE

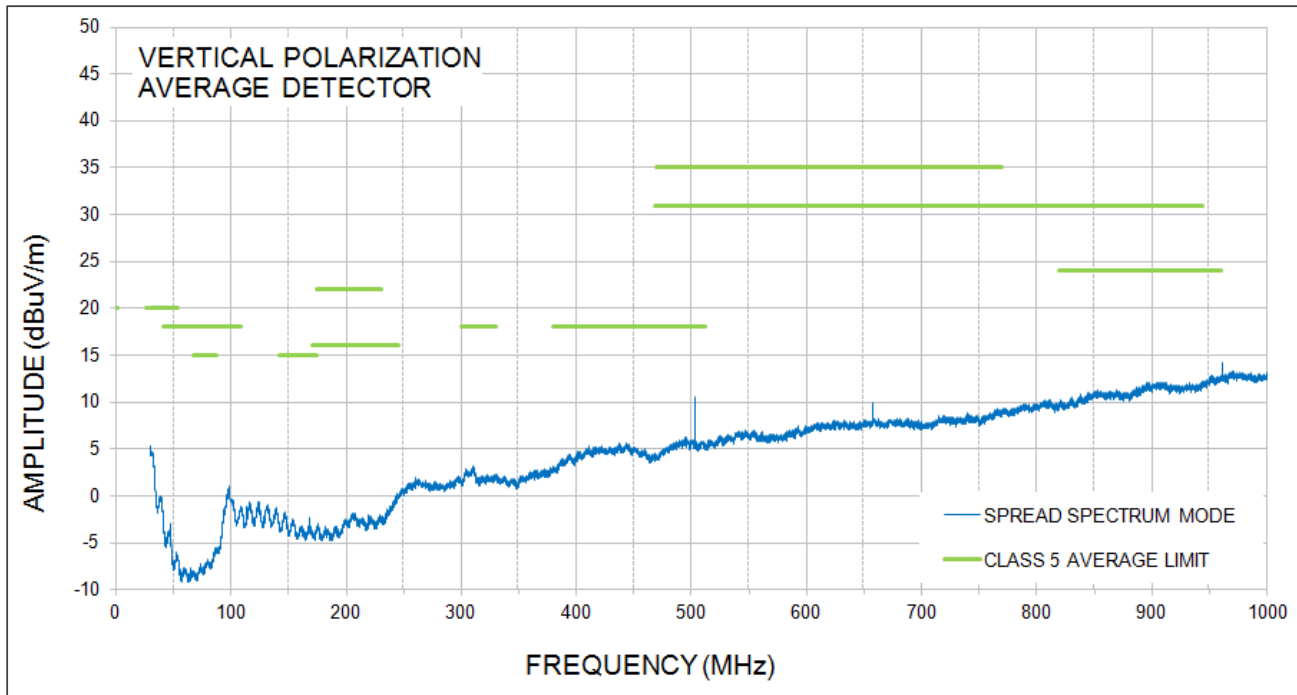


Figure 3. LT8606 Demo Circuit EMI Performance in CISPR25 Radiated Emission Test, Antenna Polarization: Vertical, Average Detector ( $V_{IN} = 14V$ ,  $V_{OUT} = 5V$ ,  $I_{OUT} = 0.35A$ , 2MHz Switching Frequency)

## QUICK START PROCEDURE

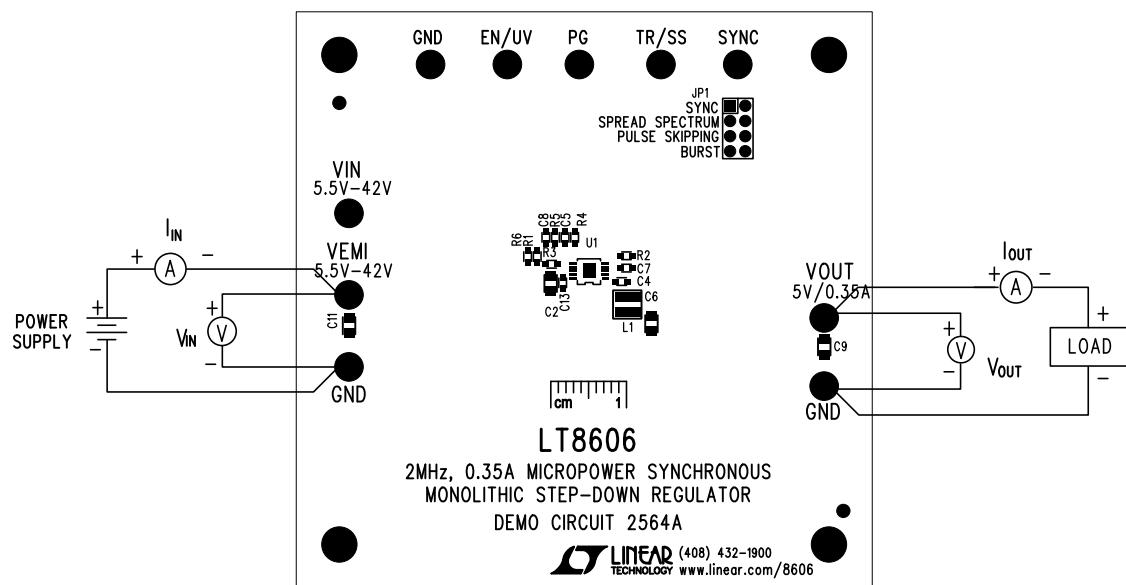


Figure 4. Proper Measurement Equipment Setup

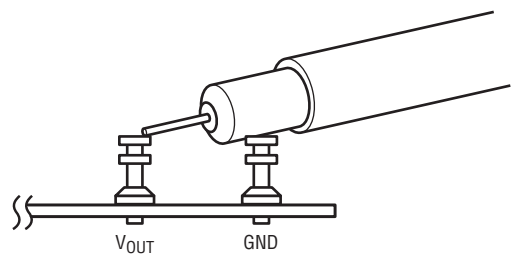


Figure 5. Measuring Output Ripple

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## PARTS LIST

| ITEM                                            | QTY | REFERENCE    | PART DESCRIPTION                        | MANUFACTURER/PART NUMBER          |
|-------------------------------------------------|-----|--------------|-----------------------------------------|-----------------------------------|
| <b>Required Circuit Components</b>              |     |              |                                         |                                   |
| 1                                               | 1   | C2           | CAP., X7R, 1 $\mu$ F, 50V, 10% 0805     | MURATA, GRM21BR71H105KA12L        |
| 2                                               | 1   | C4           | CAP., X7R, 0.22 $\mu$ F, 16V, 10%, 0603 | MURATA, GRM188R71C224KA01D        |
| 3                                               | 1   | C5           | CAP., C0G, 10pF, 25V, 5%, 0603          | AVX, 06033A100JAT2A               |
| 4                                               | 1   | C6           | CAP., X7R, 10 $\mu$ F, 10V, 10%, 0805   | MURATA, GRM21BR71A106KE51K        |
| 5                                               | 1   | C7           | CAP., X7R, 1 $\mu$ F, 25V, 10%, 0603    | MURATA, GRM188R71E105KA12D        |
| 6                                               | 1   | C8           | CAP., X7R, 0.01 $\mu$ F, 16V, 10%, 0603 | MURATA, GRM188R71C103KA01D        |
| 7                                               | 1   | L1           | IND., 4.7 $\mu$ H                       | WURTH ELECTRONICS, 74438336047    |
| 8                                               | 1   | R2           | RES., CHIP, 18.2k, 1/10W, 1%, 0603      | VISHAY, CRCW060318K2FKEA          |
| 9                                               | 1   | R3           | RES., CHIP, 49.9k, 1/10W, 1%, 0603      | VISHAY, CRCW060349K9FKEA          |
| 10                                              | 2   | R1, R4       | RES., CHIP, 1M, 1/10W, 1%, 0603         | VISHAY, CRCW06031M00FKEA          |
| 11                                              | 1   | R5           | RES., CHIP, 187k, 1/10W, 1%, 0603       | VISHAY, CRCW0603187KFKEA          |
| 12                                              | 1   | U1           | IC, REGULATOR, MSE10                    | LINEAR TECH., LT8606EMSE#PBF      |
| <b>Additional Demo Board Circuit Components</b> |     |              |                                         |                                   |
| 1                                               | 1   | C1           | CAP., ALUM 22 $\mu$ F 63V               | SUN ELECT, 63CE22BS               |
| 2                                               | 3   | C3, C10, C11 | CAP., X7R, 1 $\mu$ F, 50V, 10% 0805     | MURATA, GRM21BR71H105KA12L        |
| 3                                               | 1   | C9           | CAP., X7R, 4.7 $\mu$ F, 16V, 10%, 0805  | MURATA, GRM21BR71C475K73L         |
| 4                                               | 2   | C12, C13     | CAP., X7R, 0.1 $\mu$ F, 50V, 10%, 0603  | MURATA, GRM188R71H104KA93D        |
| 5                                               | 1   | FB1          | FERRITE BEAD 0805                       | TDK, MPZ2012S331AT000             |
| 6                                               | 1   | L2           | RES., CHIP, 0 $\Omega$ , 3/4W, 2010     | VISHAY, CRCW20100000Z0EF          |
| 7                                               | 0   | R6 (OPT.)    | RES., 0603                              |                                   |
| <b>Hardware: For Demo Board Only</b>            |     |              |                                         |                                   |
| 1                                               | 9   | E1 - E9      | TESTPOINT, TURRET, 0.094"               | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 2                                               | 1   | E10 (OPT.)   | TESTPOINT, TURRET, 0.094"               |                                   |
| 3                                               | 1   | JP1          | DOUBLE ROW HEADER 2 x 4 0.079"          | WURTH ELECTRONICS, 62000821121    |
| 4                                               | 1   | XJP1         | SHUNT, 0.079" CENTER                    | WURTH ELECTRONICS, 60800213421    |
| 5                                               | 4   | MH1-MH4      | STAND-OFF, NYLON 0.50" TALL             | WURTH ELECTRONICS, 702935000      |



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