

## LT8619

# 60V, 1.2A Synchronous Monolithic Buck Regulator with 6 $\mu$ A Quiescent Current

## DESCRIPTION

Demonstration circuit 2137A is a monolithic step-down DC/DC switching regulator featuring the LT<sup>®</sup>8619. The LT8619 is a high efficiency, high speed synchronous monolithic step-down switching regulator that consumes only 6 $\mu$ A of quiescent current. The demo circuit is designed for 5V, 1.2A output from 6V to 48V input with the transient input voltage up to 60V. The wide input range makes it suitable for regulating power from a wide variety of sources, including automotive, industrial systems and telecom supplies. The power switch, compensation and other necessary circuits are inside of the LT8619 to minimize external components and simplify design.

The LT8619 switching frequency can be programmed either via oscillator resistor or external clock over a 300kHz to 2.2MHz range. The default frequency of demo circuit 2137A is 2MHz. The SYNC pin on the demo board is grounded (JP1 at BURST position) by default for low ripple Burst Mode<sup>®</sup> operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC terminal. The R<sub>T</sub> resistor (R4) should be chosen to set the LT8619 internal switching frequency equal or below the lowest synchronization input. During clock synchronization, the controller enters forced continuous mode. Pulse-skipping mode and forced continuous mode can be selected respectively by moving JP1 shunt.

Low ripple Burst Mode operation increases the efficiency at the light load while keeping the output ripple low. Figure 1 shows the efficiency of the circuit at 12V and 24V input in Burst Mode operation (input from V<sub>IN</sub> terminal to bypass the EMI filter).

The demo board has an EMI filter installed. The EMI performance of the board (with EMI filter) is shown on Figure 2. The red line in Radiated EMI Performance is CISPR25 Class 5 peak limit. The figure shows that the circuit passes the test with a wide margin. To achieve EMI/EMC performance as shown in Figure 2, the input EMI filter is required and the input voltage should be applied at V<sub>EMI</sub> terminal.

The LT8619 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 demo circuit 2137A. The LT8619 is assembled in a small 16-lead MSOP and 10-lead 3mm × 3mm DFN packages with exposed pad. Proper board layout is essential for both low EMI operation and maximum thermal performance. See the data sheet sections for details.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2137A>**

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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 Supply Range  |  | 3     |      | 60    | V     |
| V <sub>OUT</sub> | Output Voltage      |  | 4.875 | 5    | 5.125 | V     |
| f <sub>SW</sub>  | Switching Frequency | R <sub>T</sub> = 20k $\Omega$                  | 1.9   | 2    | 2.1   | MHz   |
| I <sub>OUT</sub> | Max Output Current  |  | 1.2   |      |       | A     |
| EFE              | Efficiency at DC    | V <sub>IN</sub> = 12V, I <sub>OUT</sub> = 1.2A |       | 87.1 |       | %     |

## DESCRIPTION

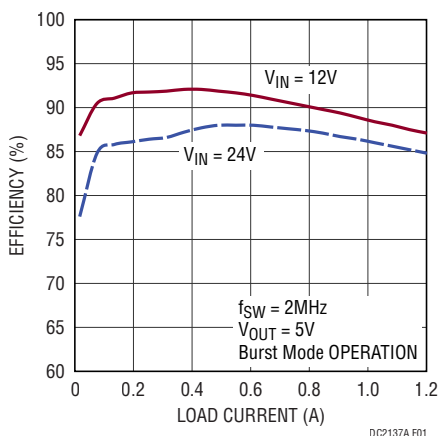


Figure 1. LT8619 DC2137A Efficiency vs Load Current

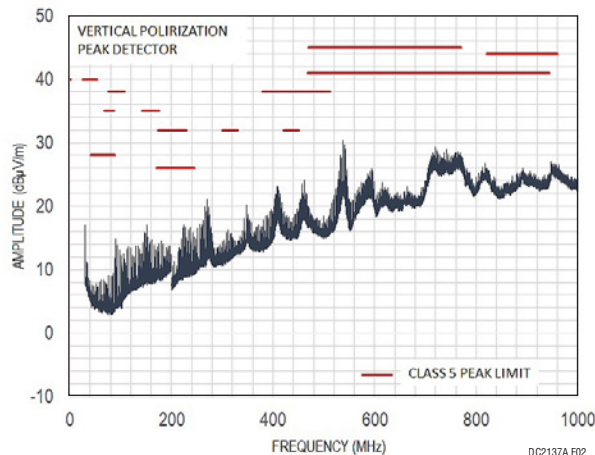


Figure 2. LT8619 DC2137A EMI Performance in CISPR25 Radiated Emission Test (12V Input from  $V_{EMI}$  Turret Pin,  $I_{OUT} = 1A$ )

## QUICK START PROCEDURE

Demonstration circuit 2137A is easy to set up to evaluate the performance of the LT8619. Refer to Figure 3 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  $V_{IN}$  or  $V_{OUT}$  and GND terminals. See Figure 4 for the proper scope technique.

- Place JP1 on the Burst Mode operation position.
- With power off, connect the input power supply to  $V_{IN1}$  and GND. Make sure that the input voltage does not exceed 60V.
- With power off, connect loads from  $V_{OUT}$  to GND.
- Turn on the power at the input.
- Check for the proper output voltage (5V).  
**NOTE:** If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.
- Once the proper output voltages are established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
- An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC/MODE position). Please make sure that R4 should be chosen to set the LT8619 switching frequency equal to or below the lowest SYNC frequency. See the data sheet Synchronization section. JP1 can also set LT8619 in pulse-skipping mode (JP1 on the PULSE-SKIPPING position) or forced continuous mode (JP1 on the FORCED CONTINUOUS position).

## Quick Start Procedure

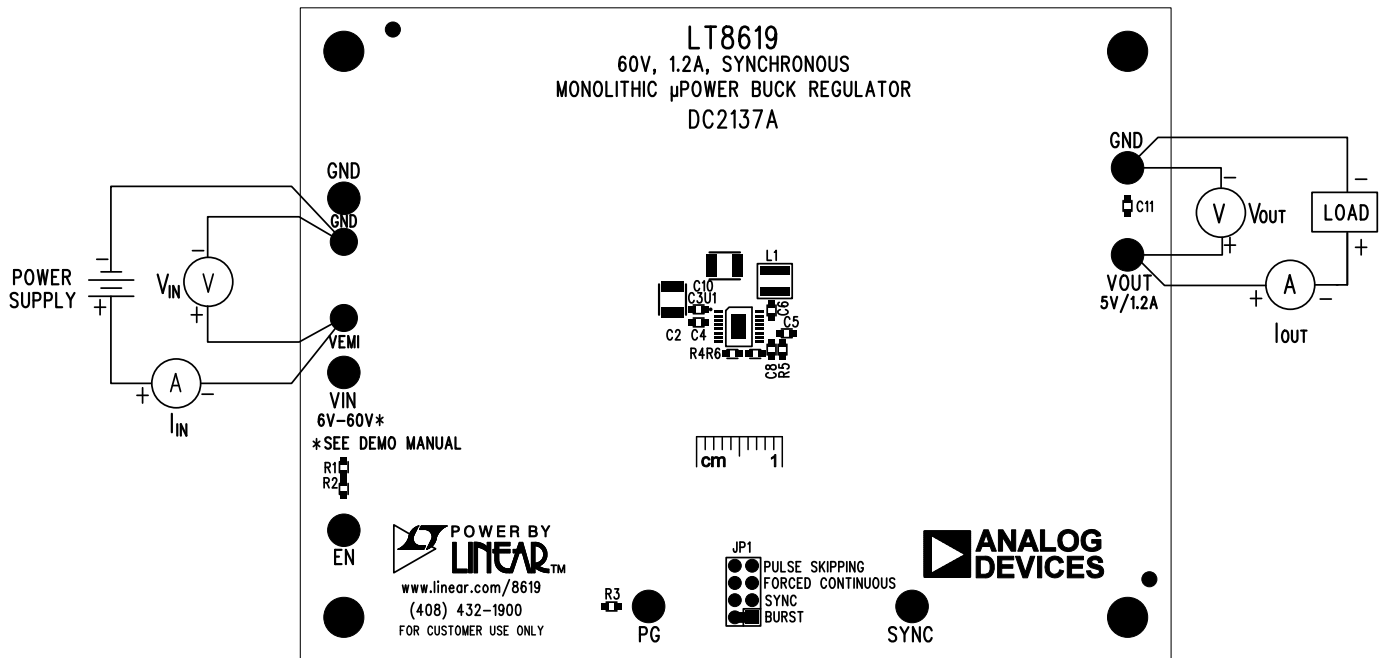


Figure 3. Proper Measurement Equipment Setup

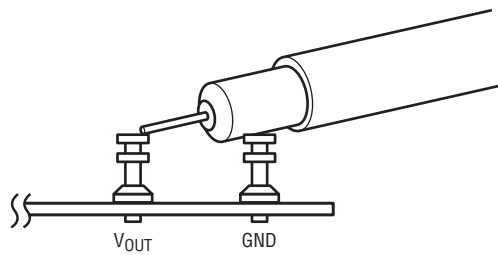


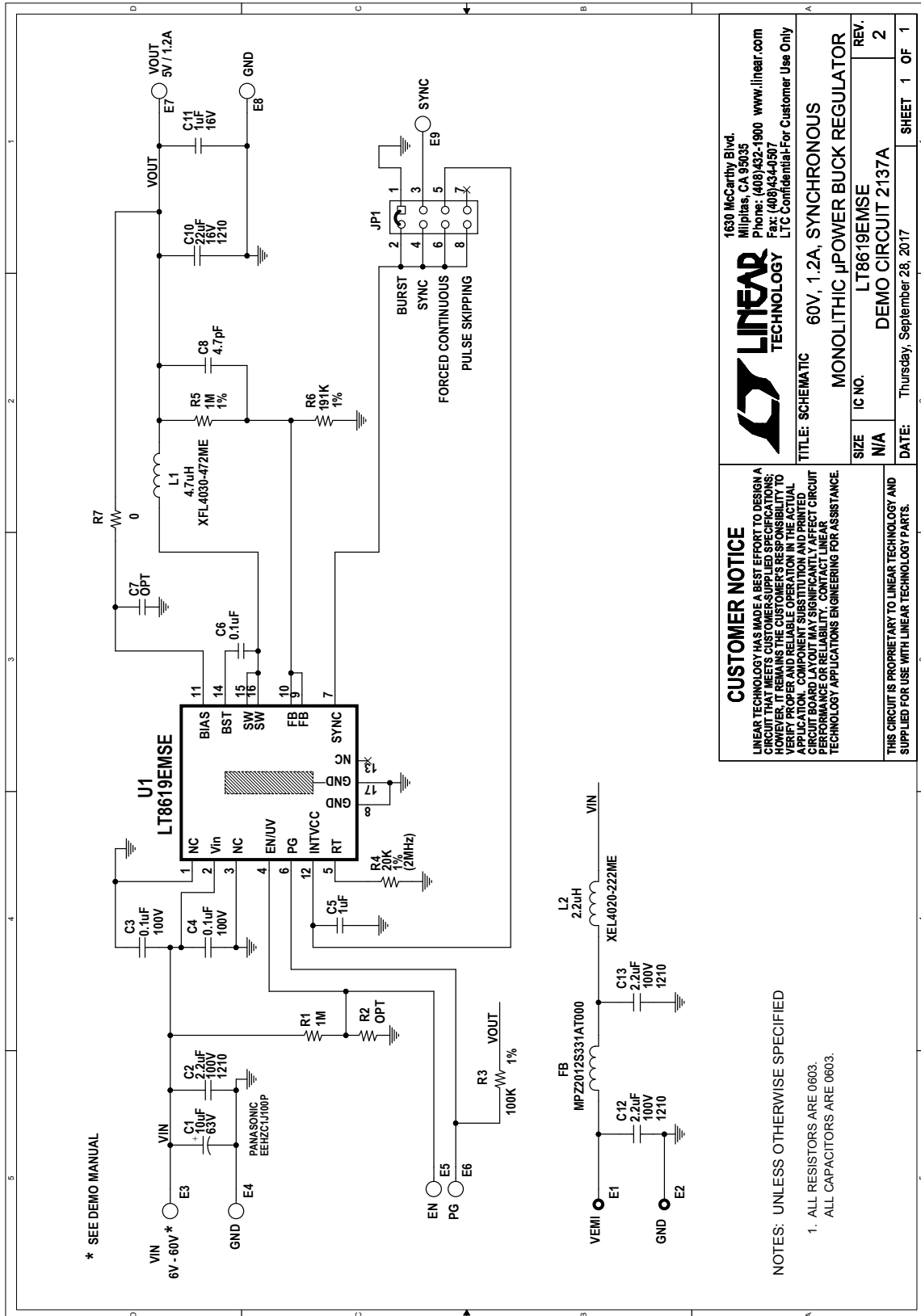
Figure 4. Measuring Input or Output Ripple

# DEMO MANUAL DC2137A

## PARTS LIST

| ITEM   | QTY | REFERENCE | PART DESCRIPTION                          | MANUFACTURER/PART NUMBER          |
|--|-----|-----------|---|-----------------------------------|
| <b>Required Demo Board Circuit Components</b>    |     |           |   |                                   |
| 1  | 1   | C2        | CAP., X7R, 2.2 $\mu$ F, 100V, 10% 1210    | TDK, C3225X7R2A225K230AB          |
| 2  | 2   | C5, C11   | CAP., X7R, 1 $\mu$ F, 25V, 10% 0603       | TDK, C1608X7R1E105K080AB          |
| 3  | 1   | C6        | CAP., X7R, 0.1 $\mu$ F, 25V, 10%, 0603    | TDK, C1608X7R1E104K080AA          |
| 4  | 1   | C8        | CAP., COG, 4.7pF, 50V, $\pm$ 0.25pF, 0603 | MURATA, GRM1885C1H4R7CA01D        |
| 5  | 1   | C10       | CAP., X7R, 22 $\mu$ F, 16V, 10% 1210      | MURATA, GRM32ER71C226KE18L        |
| 6  | 1   | L1        | IND., 4.7 $\mu$ H, XFL4030                | COILCRAFT, XFL4030-472ME          |
| 7  | 2   | R1, R5    | RES., CHIP, 1M, 1/10W, 1% 0603            | VISHAY, CRCW06031M00FKEA          |
| 8  | 1   | R3        | RES., CHIP, 100k, 1/10W, 1% 0603          | VISHAY, CRCW0603100KFKEA          |
| 9  | 1   | R4        | RES., CHIP, 20k, 1/10W, 1% 0603           | VISHAY, CRCW060320K0FKEA          |
| 10   | 1   | R6        | RES., CHIP, 191k, 1/10W, 1% 0603          | VISHAY, CRCW0603191KFKEA          |
| 11   | 1   | R7        | RES., CHIP, 0 $\Omega$ , 1/10W, 0603      | VISHAY, CRCW06030000Z0EA          |
| 12   | 1   | U1        | I.C., BUCK REGULATOR, MSOP-16E            | ANALOG DEVICES, LT8619EMSE#PBF    |
| <b>Additional Demo Board Circuit Components</b>  |     |           |   |                                   |
| 1  | 2   | C12, 13   | CAP., X7R, 2.2 $\mu$ F, 100V, 10% 1210    | TDK, C3225X7R2A225K230AB          |
| 2  | 2   | C3, C4    | CAP., X7R, 0.1 $\mu$ F, 100V, 10% 0603    | MURATA, GRM188R72A104KA35D        |
| 3  | 1   | C1        | CAP., ALUM. ELECTRO., 10 $\mu$ F, 63V     | PANASONIC, EEH2C1J100P            |
| 4  | 1   | FB        | BEAD, 330 $\Omega$ , MPZ2012              | TDK, MPZ2012S331AT000             |
| 5  | 1   | L2        | IND., 2.2 $\mu$ H, XEL4020                | COILCRAFT, XEL4020-222ME          |
| 6  | 0   | C7        | CAP., 0603 (OPT)                          |                                   |
| 7  | 0   | R2        | RES., CHIP, 0603 (OPT)                    |                                   |
| <b>Hardware/Components (for Demo Board Only)</b> |     |           |   |                                   |
| 1  | 2   | E1, E2    | TESTPOINT, TURRET, 0.061" PBF             | MILL-MAX, 2308-2-00-80-00-00-07-0 |
| 2  | 7   | E3-E9     | TESTPOINT, TURRET, 0.094" PBF             | MILL-MAX, 2501-2-00-80-00-00-07-0 |
| 3  | 1   | JP1       | 0.079 $\times$ 4 DOUBLE ROW HEADER        | WURTH ELEKTRONIK, 62000821121     |
| 4  | 1   | XJP1      | SHUNT, 0.079" CENTER                      | WURTH ELEKTRONIK, 60800213421     |

**SCHEMATIC DIAGRAM**





## 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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