LT8614
42V, 4A Micropower Synchronous Step-Down Silent Switcher

DESCRIPTION

Demonstration circuit 2019A is a 42V, 4A micropower synchronous step-down Silent Switcher™ featuring the LT®8614. The demo board is designed for 5V output from a 5.8V to 42V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The LT8614 is a compact, ultralow emission, high efficiency and high speed synchronous monolithic step-down switching regulator. The integrated power switches and inclusion of all necessary circuitry reduce the components count and solution size. Special Silent Switcher architecture minimizes EMI/EMC emissions. Ultralow 2.5µA quiescent current in Burst Mode® operation achieves high efficiency at very light loads. Fast minimum on-time of 30ns enables high V_{IN} to low V_{OUT} conversion at high frequency.

The LT8614 switching frequency can be programmed either via oscillator resistor or external clock over a 200kHz to 3MHz range. The SYNC pin on the demo board is grounded by default for low ripple Burst Mode operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC turret. Once JP1 is on SYNC position, a DC voltage of higher than 3V can be applied to the SYNC turret for pulse-skipping operation. Figure 1 shows the efficiency of the circuit at 12V input in Burst Mode operation (input from V_{IN}). Figure 2 shows the LT8614 temperature rising on DC2019A demo board under different load conditions. The rated maximum load current is 4A, while derating is necessary for certain V_{IN} and thermal conditions.

The demo board has an EMI filter installed. The EMI performance of the board (with EMI filter) is shown in Figure 3. The red line in Figure 3 is CISPR25 Class 5 peak limit. The figure shows that the circuit passes the test with a wide margin. To use the EMI filter, the input should be tied to V_{EMI}, not V_{IN}.

The LT8614 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 2019A. The LT8614 is assembled in a 3mm × 4mm plastic QFN package with exposed pads for low thermal resistance. Proper board layout is essential for both low EMI operation and maximum thermal performance. See the data sheet sections, “Low EMI PCB Layout” and “High Temperature Considerations.”

Design files for this circuit board are available at http://www.linear.com/demo/DC2019A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		5.8		42	V
V_{OUT}	Output Voltage		4.85	5	5.15	V
I_{OUT}	Maximum Output Current	Derating is Necessary for Certain V_{IN} and Thermal Conditions	4			A
f_{SW}	Switching Frequency		1.85	2	2.15	MHz
E_{FE}	Efficiency at DC	V_{IN} = 12V, I_{OUT} = 3A		91.3		%

PERFORMANCE

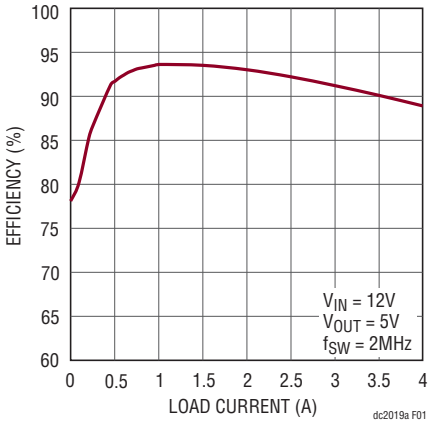


Figure 1. Efficiency vs Load Current

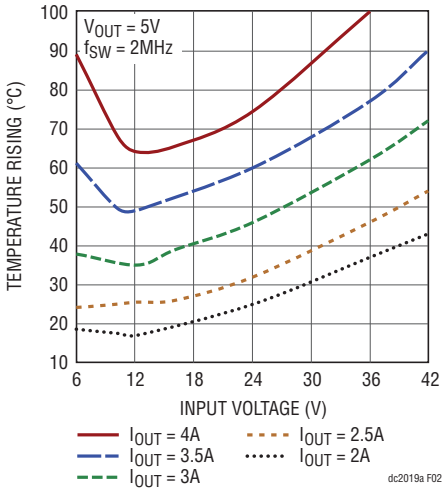


Figure 2. Temperature Rising vs Input Voltage

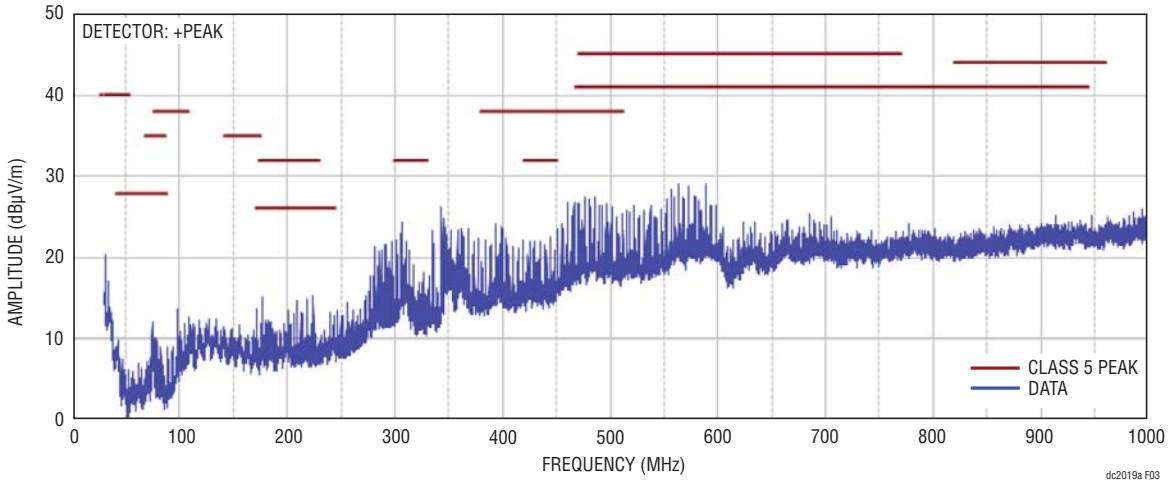


Figure 3. LT8614 Demo Circuit EMI Performance in CISPR25 Radiated Emission Test (V_{IN} = 14V, I_{OUT} = 4A)

QUICK START PROCEDURE

Demonstration circuit 2019A is easy to set up to evaluate the performance of the LT8614. 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. 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 5 for the proper scope technique.

1. Place JP1 on GND position.
2. With power off, connect the input power supply to V_{IN} and GND.
3. With power off, connect the load from V_{OUT} to GND.
4. Turn on the power at the input.

   NOTE: Make sure that the input voltage does not exceed 42V.
5. Check for the proper output voltage (V_{OUT} = 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.
6. Once the proper output voltage is established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
7. 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 LT8614 switching frequency to equal or below the lowest SYNC frequency. See the data sheet section, "Synchronization."

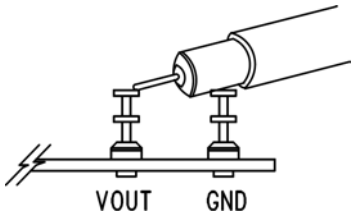


Figure 5. Measuring Output Ripple

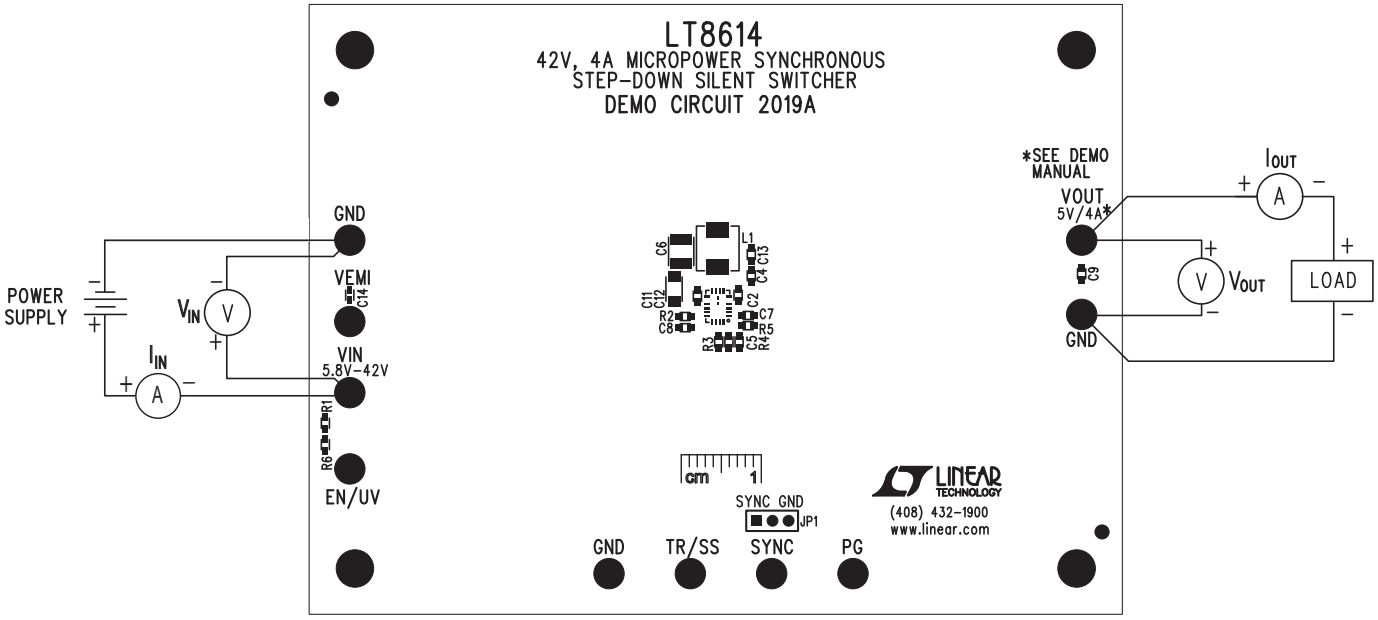
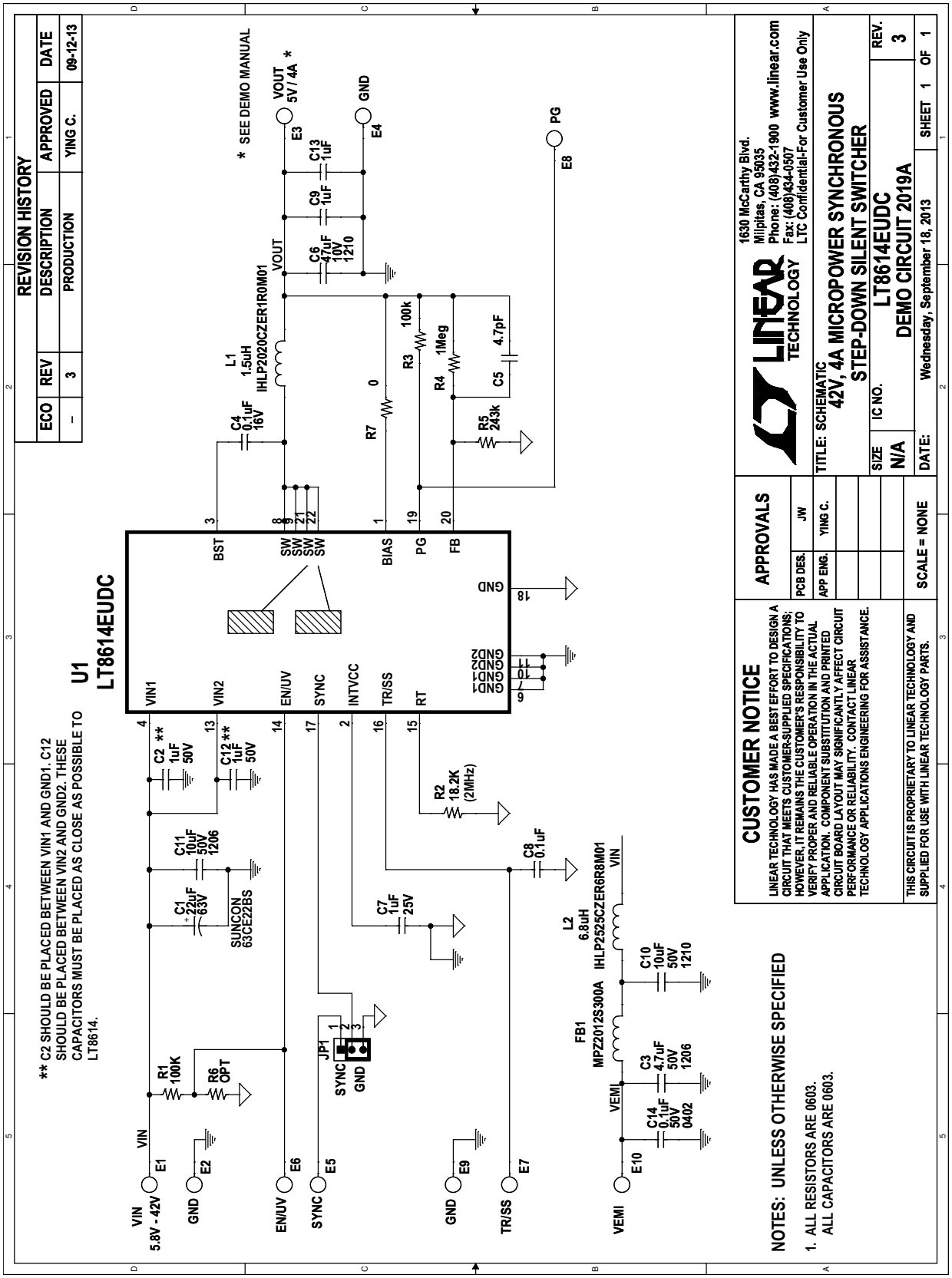


Figure 4. Proper Measurement Equipment Setup

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C2, C12	CAP., X5R, 1µF, 50V, 10%, 0603	TDK, C1608X5R1H105K
2	2	C4,C8	CAP., X7R, 0.1µF, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
3	1	C5	CAP., C0G, 4.7pF, 25V, ±0.25p, 0603	AVX, 06033A4R7CAT2A
4	1	C6	CAP., X7R, 47µF, 10V, 10%, 1210	MURATA, GRM32ER71A476KE15L
5	3	C7, C9, C13	CAP., X7R, 1µF, 25V, 10%, 0603	MURATA, GRM188R71E105KA12D
6	1	C11	CAP., X5R, 10µF, 50V, 10%, 1206	TDK, C3216X5R1H106K
7	1	L1	IND, 1.5µH, IHLP2020CZ-01	VISHAY, IHLP2020CZER1R5M01
8	2	R1, R3	RES., CHIP, 100k, 1/16W, 1%, 0603	VISHAY, CRCW0603100KFKED
9	1	R2	RES., CHIP, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
10	1	R4	RES., CHIP, 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
11	1	R5	RES., CHIP, 243k, 1/10W, 1%, 0603	VISHAY, CRCW0603243KFKEA
12	1	U1	IC, REGULATOR, 20-QFN, UDC	LINEAR TECHNOLOGY, LT8614EUDC#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP., ALUM, 22µF, 63V	SUN ELECT., 63CE22BS
2	1	C3	CAP., X7R, 4.7µF, 50V, 10%, 1206	MURATA, GRM31CR71H475KA12L
3	1	C10	CAP., X7R, 10µF, 50V, 10%, 1210	MURATA, GRM32ER71H106KA12L
4	1	C14	CAP., X7R, 0.1µF, 50V, 10%, 0402	TDK, C1005X7R1H104K
5	1	FB1	CHIP BEAD, MPZ2012	TDK, MPZ2012S300A
6	1	L2	IND., 6.8µH, IHLP2525CZ-01	VISHAY, IHLP2525CZER6R8M01
7	0	R6 (OPT)	RES., 0603	
8	1	R7	RES., CHIP, 0, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
Hardware: For Demo Board Only				
1	10	E1-E10	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	SULLINS, NRPN031PAEN-RC
3	1	XJP1	SHUNT, 0.079", CENTER	SAMTEC, 2SN-BK-G
4	4	MH1-MH4	STAND-OFF, NYLON, 0.50" TALL	KEYSTONE, 8833 (SNAP-ON)

SCHEMATIC DIAGRAM



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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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