LT8640
42V, 5A Micropower Synchronous Step-Down Silent Switcher

DESCRIPTION

Demonstration circuit 2202A is a 42V, 5A micropower synchronous step-down Silent Switcher® with spread spectrum frequency modulation featuring the LT®8640. The demo board is designed for 5V output from a 5.7V to 42V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The LT8640 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. Selectable spread spectrum mode can further improve EMI/EMC performance. Ultralow 2.5µA quiescent current in Burst Mode® operation achieves high efficiency at very light loads. Fast minimum on-time of 40ns enables high V_{IN} to low V_{OUT} conversion at high frequency.

The LT8640 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 (JP1 at BURST position) 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. Spread spectrum mode and pulse-skipping mode can be selected respectively by moving JP1 shunt. Figure 1 shows the efficiency of the circuit at 12V and 24V input in Burst Mode operation (input from V_{IN} turret pin). Figure 2 shows the LT8640 temperature rising on DC2202A demo board under different load conditions. The rated maximum load current is 5A, while derating is necessary for certain input voltage and thermal conditions.

The demo board has an EMI filter installed. The EMI performance of the board (with EMI filter) is shown on 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 achieve EMI/EMC performance as shown in Figure 3, the input EMI filter is required and the input voltage should be applied at VEMI turret pin. An inductor L2, which is a 0Ω jumper on the board by default now, can be added in the EMI filter to further reduce the conducted emission.

The LT8640 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 2202A. The LT8640 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 Thermal Considerations and Peak Output Current.

Design files for this circuit board are available at http://www.linear.com/demo/DC2202A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		5.7		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	5			A
f_{SW}	Switching Frequency		1.85	2	2.15	MHz
EFE	Efficiency at DC	V_{IN} = 12V , I_{OUT} = 3A		93.7		%

QUICK START PROCEDURE

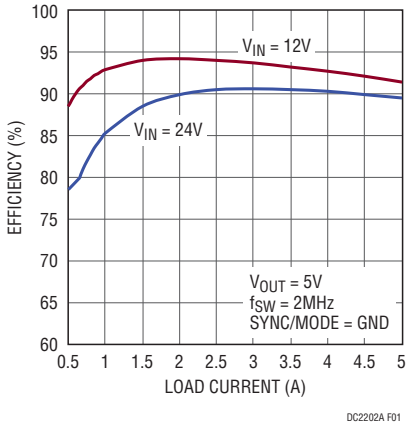


Figure 1. LT8640 Demo Circuit DC2202A Efficiency vs Load Current (Input from V_{IN} Turret Pin)

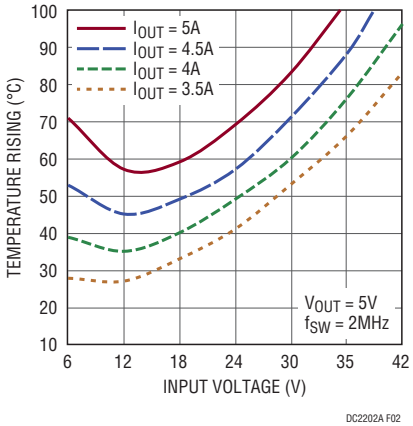


Figure 2. LT8640 Demo Circuit DC2202A Temperature Rising vs Input Voltage

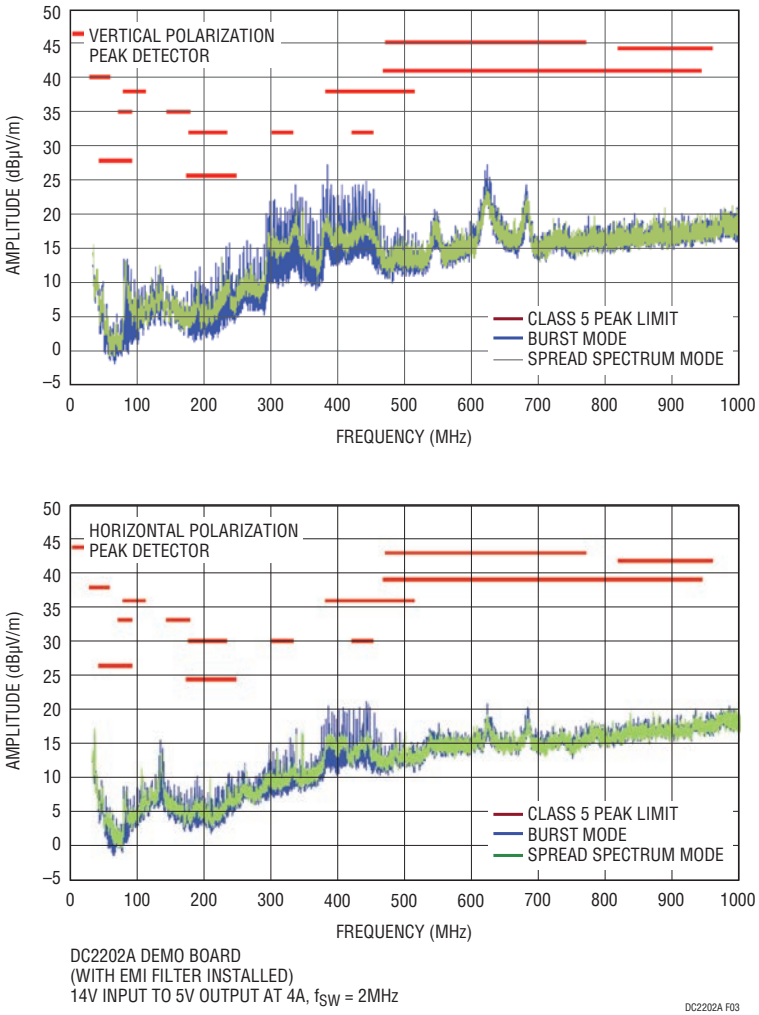


Figure 3. LT8640 Demo Circuit DC2202A EMI Performance in CISPR25 Radiated Emission Test (14V Input from VEMI Turret Pin, I_{OUT} = 4A)

QUICK START PROCEDURE

Demonstration circuit 2202A is easy to set up to evaluate the performance of the LT8640. 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 BURST position.
2. With power off, connect the input power supply to V_{EMI} and GND. If the EMI/EMC performance is not important, the input EMI filter can be bypassed by connecting 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 make sure that RT should be chose to set the LT8640 switching frequency equal to or below the lowest SYNC frequency. JP1 can also set LT8640 in spread spectrum mode (JP1 on the SPREAD-SPECTRUM position) or pulse-skipping mode (JP1 on the PULSE-SKIPPING position).

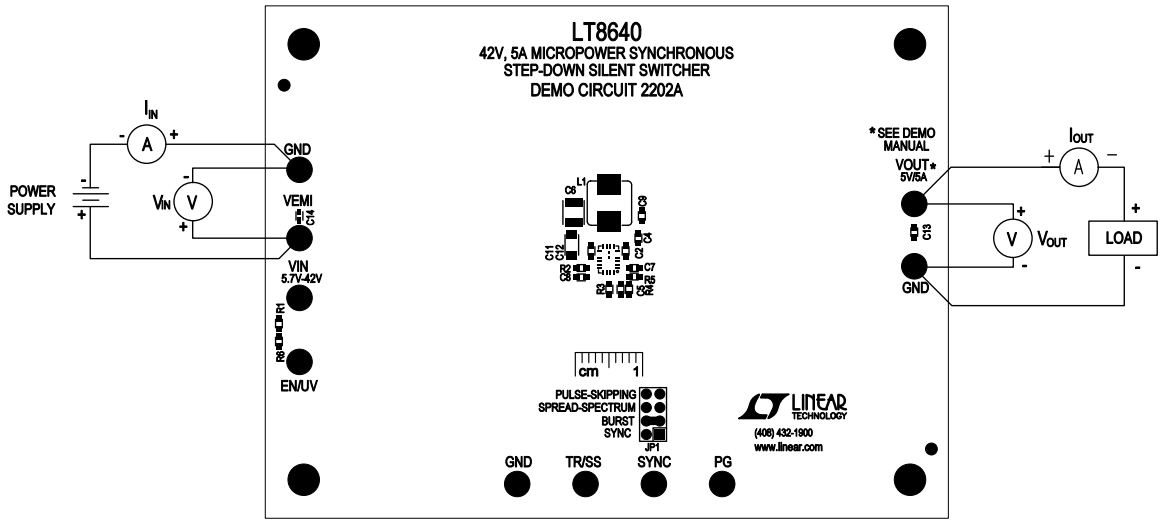


Figure 4. Proper Measurement Equipment Setup

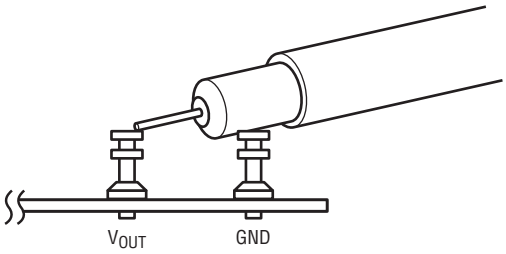
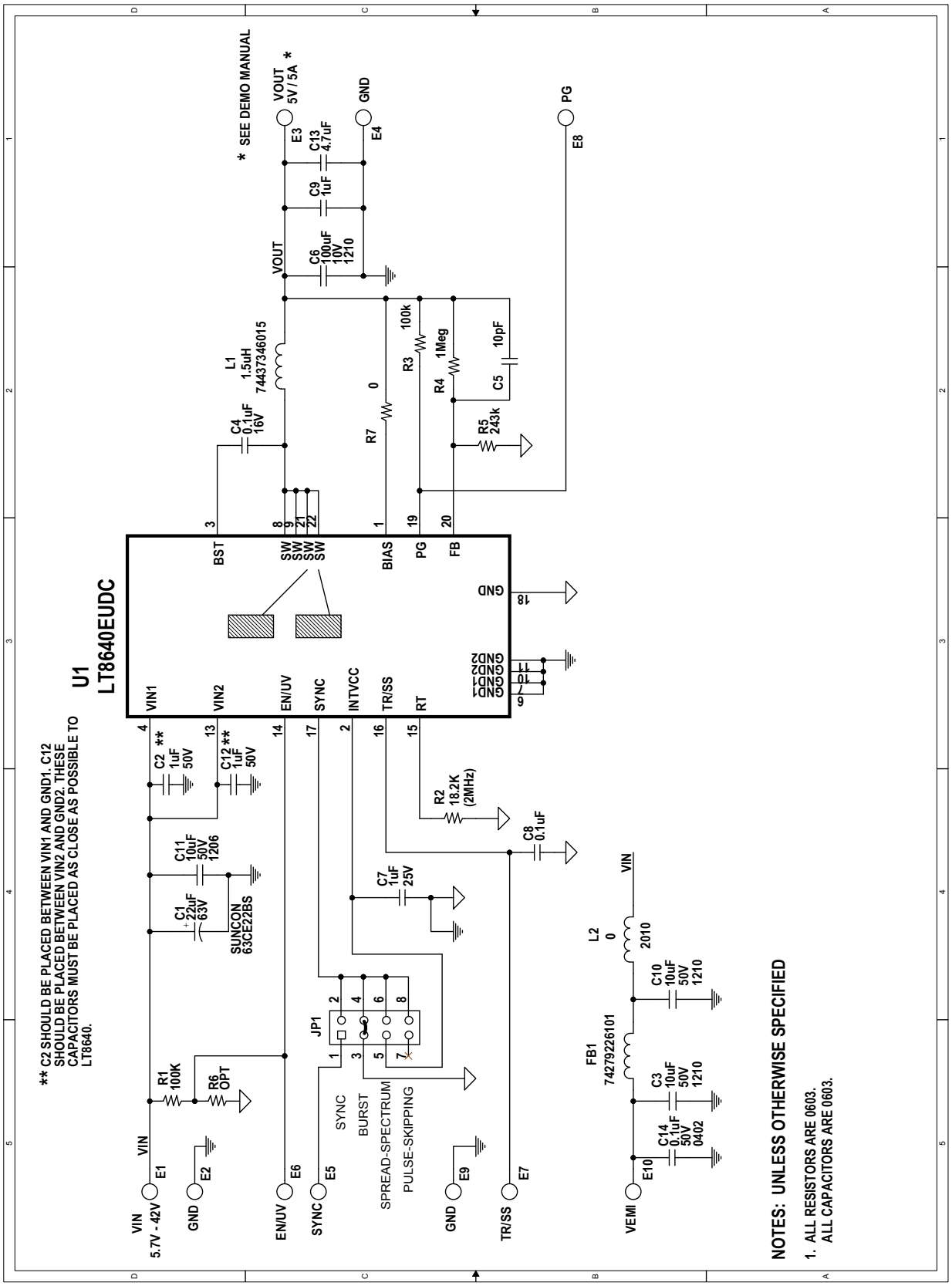


Figure 5. Measuring Output Ripple

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, 10pF, 25V, ±0.25p 0603	AVX, 06033A100CAT2A
4	1	C6	CAP., X5R, 100µF, 10V, 20% 1210	SAMSUNG, CL32A107MPVNNNE
5	2	C7, C9	CAP., X7R, 1.0µF, 25V, 10% 0603	MURATA, GRM188R71E105KA12D
6	1	C11	CAP., X5R, 10µF, 50V, 10% 1206	TDK, C3216X5R1H106K
7	1	C13	CAP., X5R, 4.7µF, 25V, 10% 0603	MURATA, GRM188R61E475KE11D
8	1	L1	INDUCTOR,1.5µH	WÜRTH ELEKTRONIK, 74437346015
8	2	R1, R3	RES., CHIP., 100k, 1/10W, 1% 0603	VISHAY, CRCW0603100KFKEA
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 TECH. CORP., LT8640EUDC#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP., ALUM 22µF, 63V	SUN ELECT., 63CE22BS
2	2	C3, C10	CAP., X7R, 10µF, 50V, 10% 1210	MURATA, GRM32ER71H106KA12L
3	1	C14	CAP., X7R, 0.1µF, 50V, 10% 0402	TDK, C1005X7R1H104K
4	1	FB1	CHIP BEAD	WÜRTH ELEKTRONIK, 74279226101
5	1	L2	RES., CHIP., 0Ω, 3/4W, 2010	VISHAY, CRCW20100000Z0EF
6	0	R6 (OPT)	RES., 0603	
7	1	R7	RES., CHIP., 0, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
Hardware: For Demo Board Only				
1	10	E1-E10	TESTPOINT, TURRET, .094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	2×4, 0.079 DOUBLE ROW HEADER	WÜRTH ELEKTRONIK, 62000821121
3	1	XJP1	SHUNT, 0.079" CENTER	WÜRTH ELEKTRONIK, 60800213421
4	4	MH1-MH4	STAND-OFF, NYLON 0.50" TALL	WÜRTH ELEKTRONIK, 702935000

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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