LT8641
65V, 3.5A Micropower Synchronous Step-Down Silent Switcher

DESCRIPTION

Demonstration circuit 2373A is a 65V, 3.5A micropower synchronous step-down Silent Switcher® with spread spectrum frequency modulation featuring the LT®8641. The demo board is designed for 5V output from a 5.5V to 65V input. The wide input range allows a variety of input sources, such as automotive batteries and industrial supplies. The LT8641 is a compact, ultralow emission, high efficiency, high speed synchronous monolithic step-down switching regulator that consumes only 2.5µA of quiescent current when output is regulated at 5V. Top and bottom power switches, compensation components and other necessary circuits are inside of the LT8641 to minimize external components and simplify design.

The SYNC pin on the demo board is grounded by default for low ripple burst mode operation. Move JP1 to PULSE SKIPPING position can change the operation mode to pulse-skipping operation. Once JP1 is on SPREAD SPECTRUM position, V_{CC} 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 at 12V and 24V input in Burst Mode® operation (input from V_{IN} turret pin). Figure 2 shows the LT8641 temperature rising on DC2373A demo board under different load conditions. The rated maximum load current is 3.5A, while derating is necessary for certain input voltage and thermal conditions.

The demo board has an EMI filter installed. Under burst and spread spectrum operation, the EMI performances of the board (with EMI filter) are shown in Figure 3 and 4. The red lines in Figure 3 and 4 are CISPR25 Class5 peak limit. To achieve EMI/EMC performance as shown in Figure 3 and 4, the input EMI filter is required and the input voltage should be applied at VEMI turret pin.

This board is suitable for a wide range of automotive, telecom, industrial, and other applications.

The LT8641 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 DC2373A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2373A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Voltage Range		5.5		65	V
V_{OUT}	Output Voltage		4.8	5	5.2	V
I_{OUT}	Maximum Output Current	Derating Is Necessary for Certain V_{IN} and Thermal Conditions	3.5			A
f_{SW}	Switching Frequency		1.85	2	2.15	MHz
EFF	Efficiency	V_{IN} = 12V, I_{OUT} = 1A		94		%

QUICK START PROCEDURE

DC2373A is easy to set up to evaluate the performance of the LT8641. Refer to Figure 5 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 6 for the proper scope technique.

1. Set an input power supply that is capable of 65V/3.5A. Then turn off the supply.
2. With power off, connect the supply to the input terminals VEMI and GND.
3. Turn on the power at the input.

NOTE: Make sure that the input voltage never exceeds 65V.

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 3.5A 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 DC2373A'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 again established, 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 LT8641 switching frequency to equal or below the lowest SYNC frequency. See the data sheet section, Synchronization.

QUICK START PROCEDURE

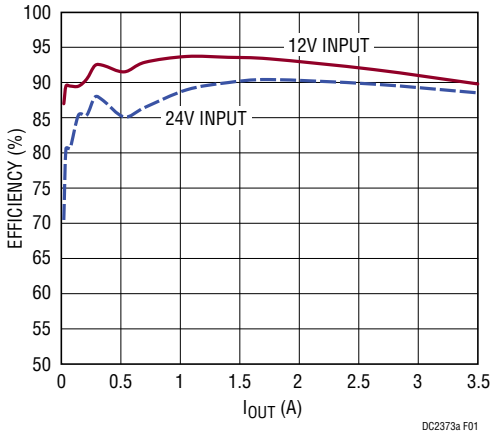


Figure 1. Efficiency vs Load Current at 2MHz Switching Frequency

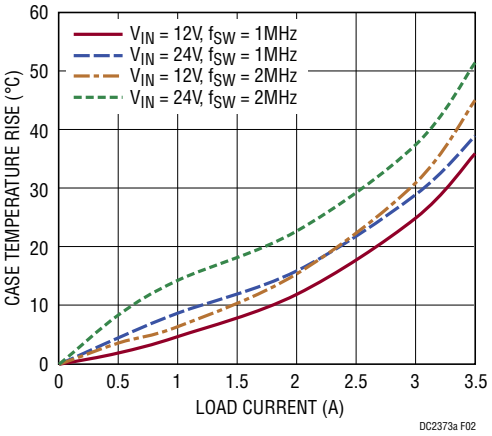


Figure 2. DC2373A Temperature Rising vs Load Current

QUICK START PROCEDURE

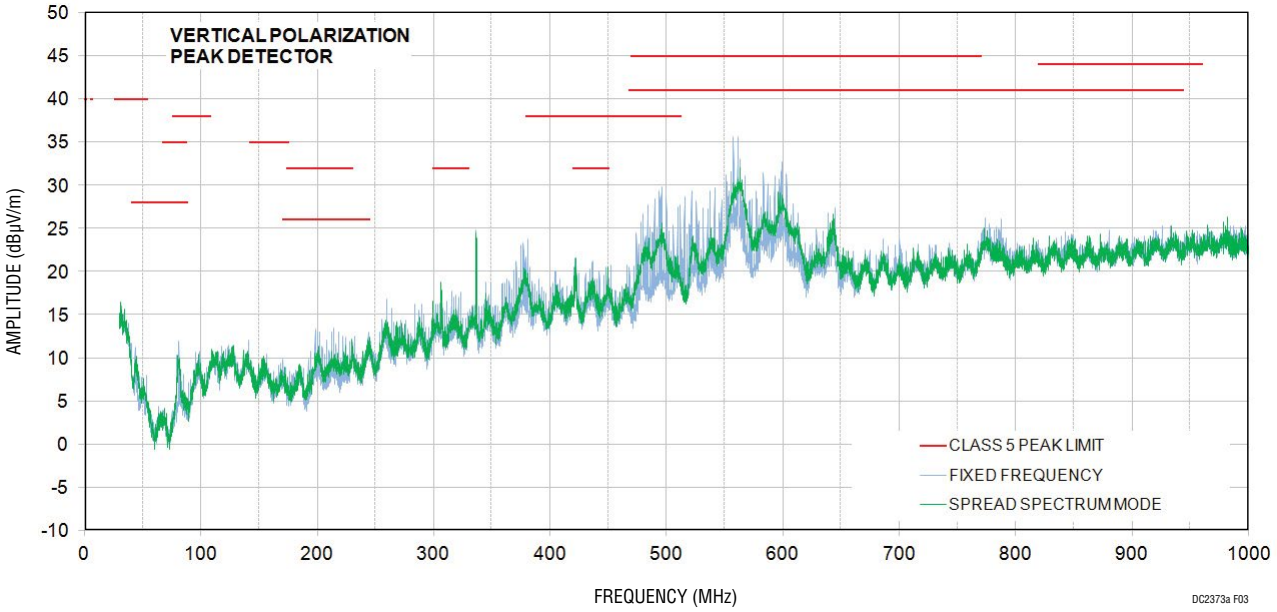


Figure 3. LT8641 Demo Circuit EMI Performance in CISPR25 Radiated Emission Test, Antenna Polarization: Vertical (V_{IN} = 14V, V_{OUT} = 5V, I_{OUT} = 3.5A, 2MHz Switching Frequency)

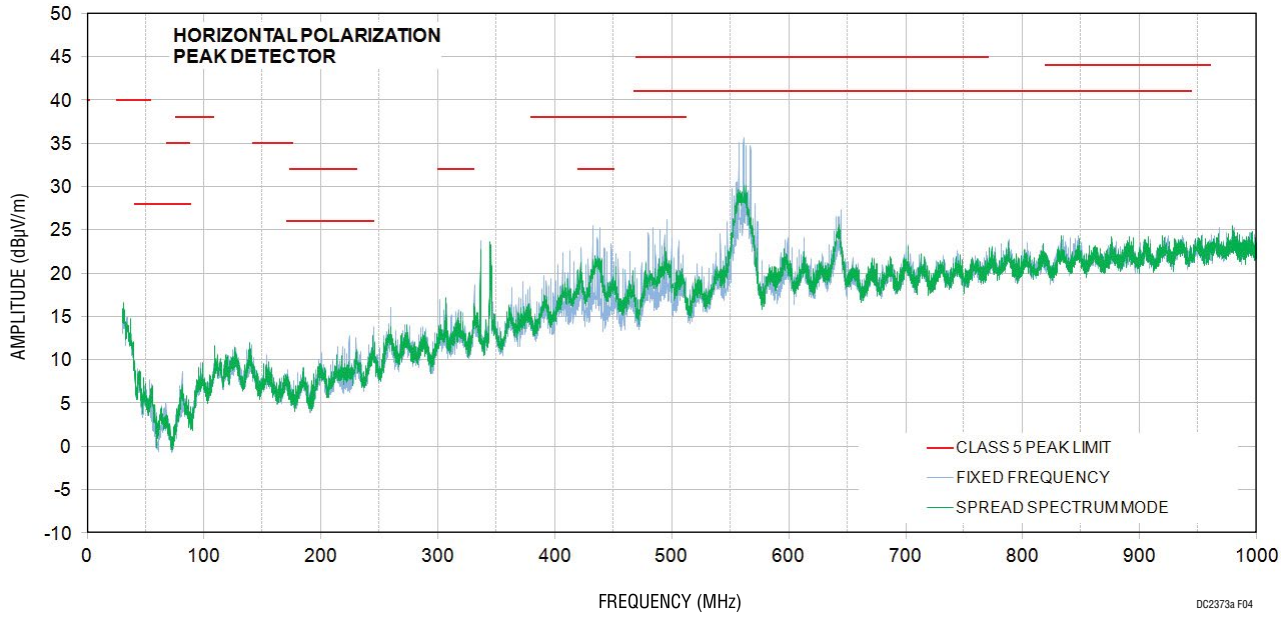


Figure 4. LT8641 Demo Circuit EMI Performance in CISPR25 Radiated Emission Test, Antenna Polarization: Horizontal (V_{IN} = 14V, V_{OUT} = 5V, I_{OUT} = 3.5A, 2MHz Switching Frequency)

QUICK START PROCEDURE

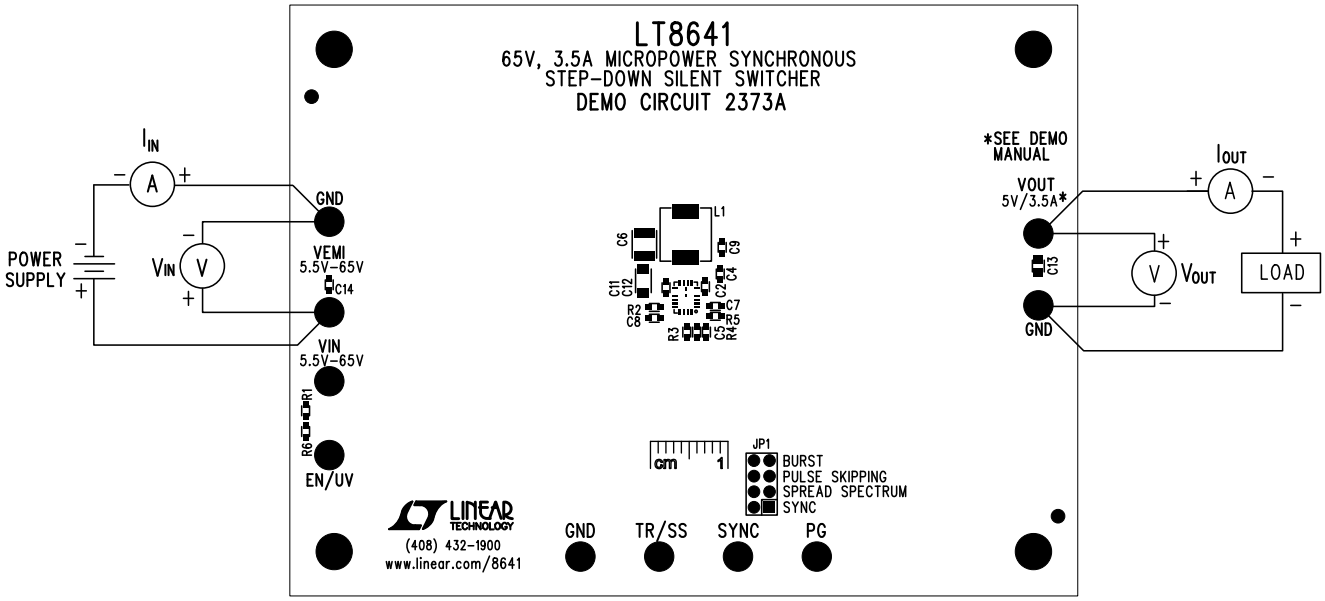


Figure 5. Proper Measurement Equipment Setup

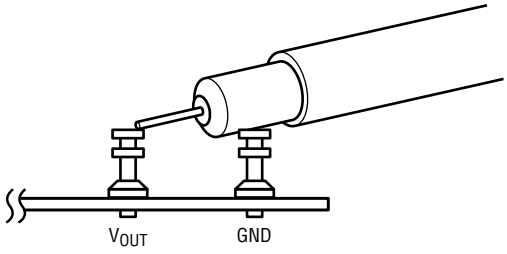
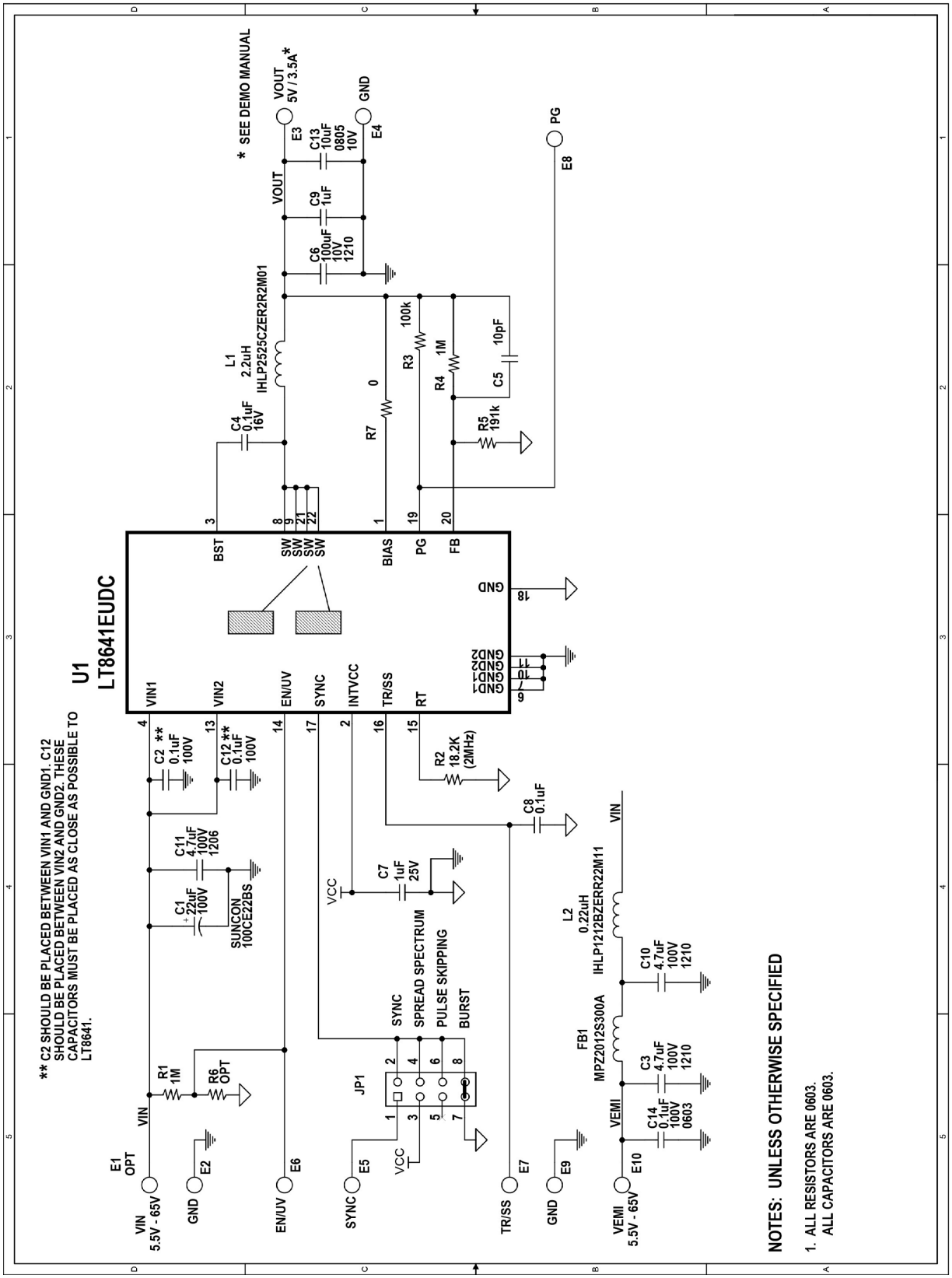


Figure 6. Measuring Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C2, C12	CAP, X7R, 0.1µF, 100V, 10%, 0603	MURATA, GRM188R72A104KA35D
2	2	C4, C8	CAP, X7R, 0.1µF, 16V, 10%, 0603	MURATA, GRM188R71C104KA01D
3	1	C5	CAP, C0G, 10pF, 25V, 5%, 0603	AVX, 06033A100CAT2A
4	1	C6	CAP, X5R, 100µF, 10V, 20%, 1210	MURATA, GRM32ER61A107ME20L
5	1	C7	CAP, X7R, 1µF, 25V, 10%, 0603	MURATA, GRM188R71E105KA12D
6	1	C11	CAP, X7S, 4.7µF, 100V, 10%, 1206	AVX, 12061Z475KAT2A
7	1	L1	IND, 2.2µH	VISHAY, IHLP2525CZER2R2M01
8	2	R1, R4	RES, CHIP, 1M, 1/10W, 1%, 0603	VISHAY, CRCW06031M00FKEA
9	1	R2	RES, CHIP, 18.2k, 1/10W, 1%, 0603	VISHAY, CRCW060318K2FKEA
10	1	R3	RES, CHIP, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
11	1	R5	RES, CHIP, 191k, 1/10W, 1%, 0603	VISHAY, CRCW0603191KFKEA
12	1	R7	RES, CHIP, 0, 1/10W, 1%, 0604	VISHAY, CRCW06030000Z0EA
13	1	U1	IC, REGULATOR, 20-QFN, UDC	LINEAR TECH,LT8641EUDC#PBF
Additional Demo Board Circuit Components				
1	1	C1	CAP, ALUM 22µF, 100V	SUN ELECT, 100CE22BS
2	2	C3, C10	CAP, X7S, 4.7µF, 100V, 10%, 1210	TDK, C3225X7S2A475K200AB
3	1	C9	CAP, X7R, 1µF, 25V, 10%, 0603	MURATA, GRM188R71E105KA12D
4	1	C13	CAP, X7R, 10µF, 10V, 10%, 0805	MURATA, GRM21BR71A106KE51L
5	1	C14	CAP, X7R, 0.1µF, 100V, 10%, 0603	MURATA, GRM188R72A104KA35D
6	1	FB1	FERRITE BEAD, 0805	TDK, MPZ2012S300A
7	1	L2	IND, 0.22µH	VISHAY, IHLP1212BZERR22M11
8	0	R6 (OPT)	RES, 0603	
Hardware: For Demo Board Only				
1	9	E2 TO E10	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	E1 (OPT)	TESTPOINT, TURRET, 0.094"	
3	1	JP1	DOUBLE ROW HEADER 2 x 4 0.079"	SULLINS NRPN042PAEN-RC
4	1	XJP1	SHUNT, 0.079" CENTER	SAMTEC 2SN-BK-G
5	4	MH1 TO 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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