EVAL-LT8641A-AZ Demo Manual

65V, 3.5A/5A Peak Synchronous Step-Down Silent Switcher

General Description

Evaluation circuit EVAL-LT8641A-AZ is a 65V, 3.5A/5A peak synchronous step-down Silent Switcher® with spread spectrum frequency modulation featuring the LT®8641A. 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 LT8641A is a compact, ultralow emission, high efficiency, high speed synchronous monolithic step-down switching regulator. Top and bottom power switches, compensation components, and other necessary circuits inside the LT8641A minimize external components and simplify design. The special Silent Switcher architecture minimizes EMI emissions. The selectable spread spectrum mode can further improve EMI performance. Ultralow 2.5µA quiescent current in Burst Mode® operation achieves high efficiency at very light loads. Fast minimum on-time of 35ns enables high V_{IN} to low V_{OUT} conversion at high frequency.

The LT8641A switching frequency can be programmed either through oscillator resistor or external clock over a 200kHz to 3MHz range. The default frequency of the evaluation board is 2MHz. The SYNC pin on the evaluation board is grounded by JP1 for low ripple burst mode operation. Move JP1 to PULSE SKIPPING position to 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 synchronize 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.

Figure 2 shows EMI performances of the board (with EMI filter). The red lines in *Figure 2* are CISPR25 Class5 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 the V_{EMI} turret.

The LT8641A data sheet gives a complete description of the part, operation, and application information. Read the data sheet in conjunction with this user guide for EVAL-LT8641A-AZ. The LT8641A is assembled in a 3mm × 4mm plastic QFN package with exposed pad for low thermal resistance. The layout recommendations for low EMI operation and maximum thermal performance are available in the “Low EMI PCB Layout and Thermal Considerations” and “Peak Output Current” sections of the data sheet.

Performance Summary

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Voltage Range		5.50		65.00	V
V_{OUT}	Default Output Voltage	V_{IN} = 12V, I_{OUT} = 0A to 3.5A	4.80	5.00	5.20	V
I_{OUT}	Maximum Continuous Output Current	V_{IN} = 12V	3.50			A
f_{sw}	Switching Frequency		1.85	2.00	2.15	MHz
E_{ff}	Efficiency	V_{IN} = 12V, f_{SW} = 2MHz, V_{OUT} = 5V, I_{OUT} = 1A		94		%

Typical Performance Characteristics

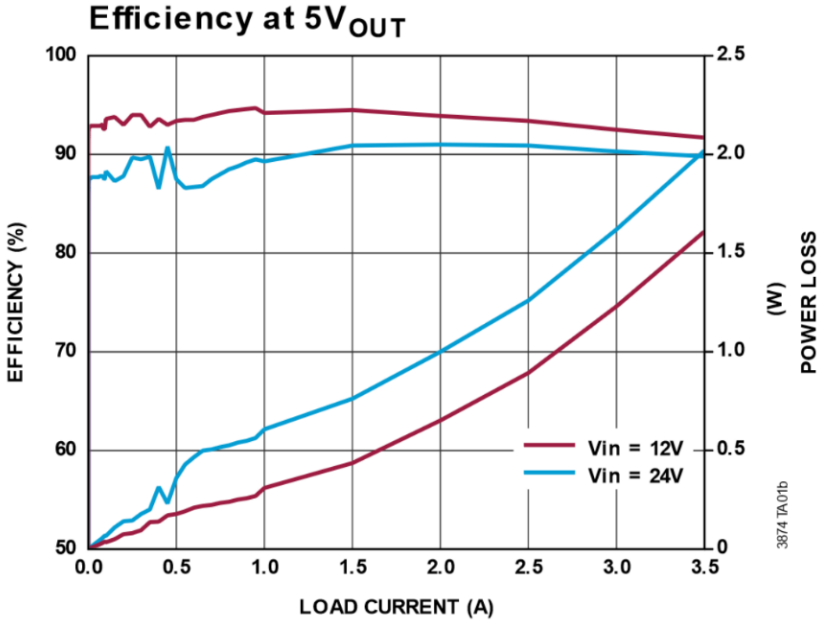
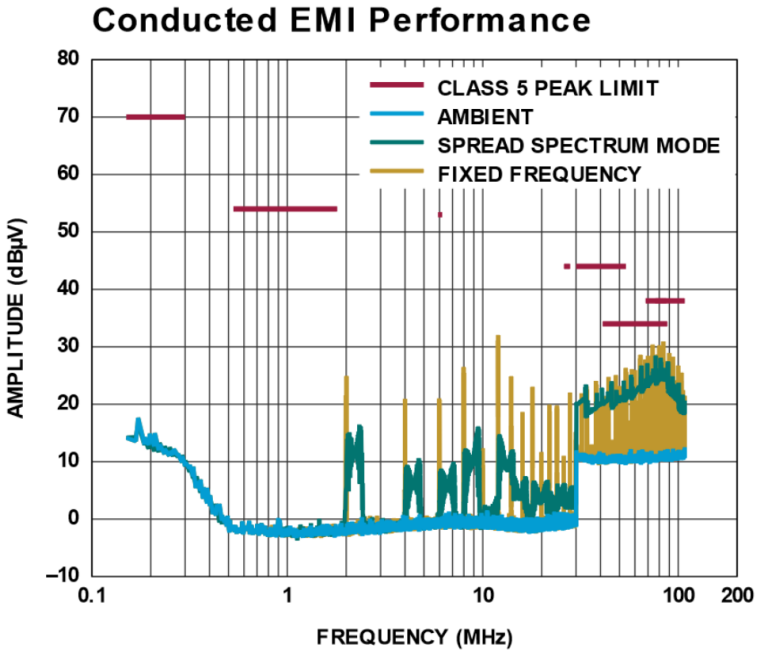


Figure 1. LT8641A Eval Circuit Efficiency vs. Load Current

(2MHz Switching Frequency, Burst Mode)



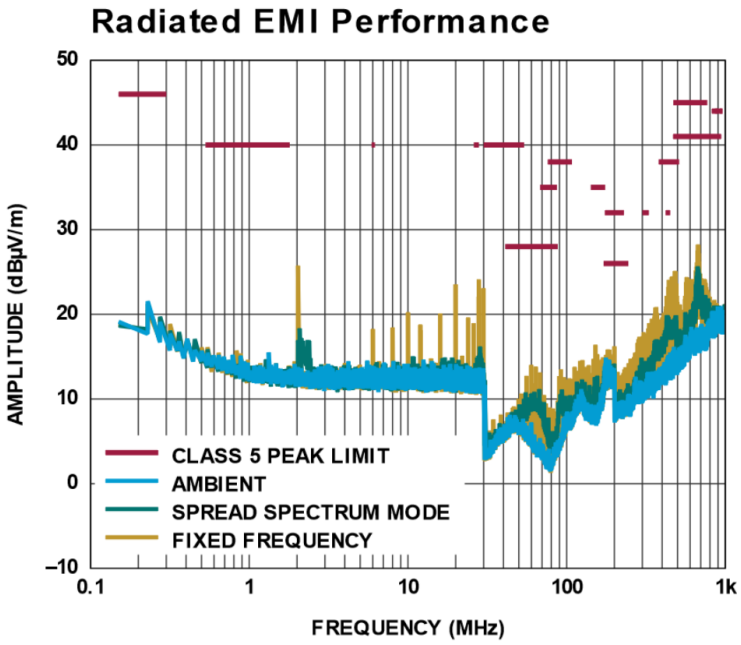


Figure 2. LT8641A Eval Circuit Conducted and Radiated EMI Performance in CISPR25 Emission Test (V_{EMI} = 14V, V_{OUT} = 5V, I_{OUT} = 3.5A, 2MHz Switching Frequency)

Quick Start Procedure

The evaluation board EVAL-LT8641A-AZ is easy to set up to evaluate the performance of the LT8641A. See ***Figure 3*** for proper measurement equipment setup and follow this procedure.

1. Set an input power supply capable of 65V/5A.
2. With power off, connect the input power supply to V_{EMI} and GND.
3. With power off, connect the loads from V_{OUT} to GND.
4. Place the voltmeters across the output voltage sense terminals V_{OUT_SENSE} and GND to get accurate output voltage measurements.
5. Turn on the power at the input.

Note: Make sure that the input voltage does not exceed 65V.

6. Check for proper output voltages. Regulate the output at 5.0V (±4%).

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

7. 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.

Note: When measuring the input or output voltage ripple, take care to avoid a long ground lead on the oscilloscope probe. Measure the output voltage ripple by touching the probe tip directly across the output capacitor. See ***Figure 4*** for the proper scope technique.

8. An external clock can be added to the SYNC terminal when SYNC function is used (JP1 on the SYNC position). Ensure the chosen RT sets the LT8641A switching frequency to equal or below the lowest SYNC frequency. Refer to the data sheet section “Synchronization and Spread Spectrum”.

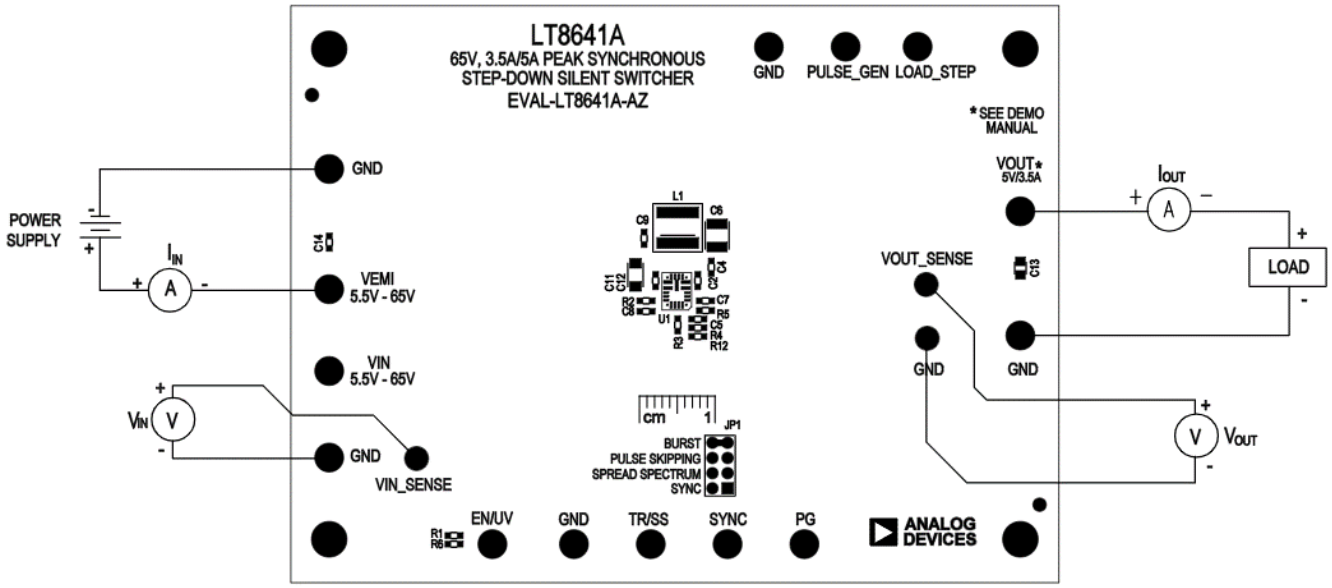


Figure 3. Proper Measurement Equipment Setup

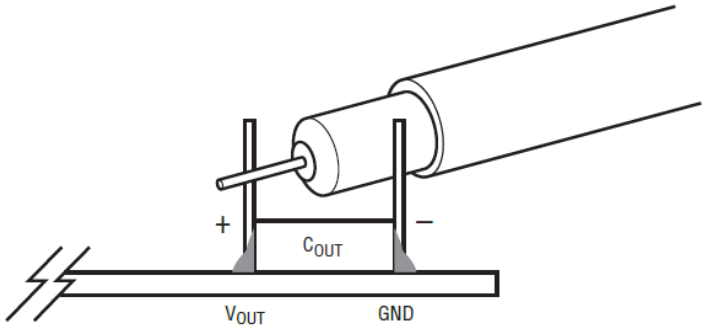
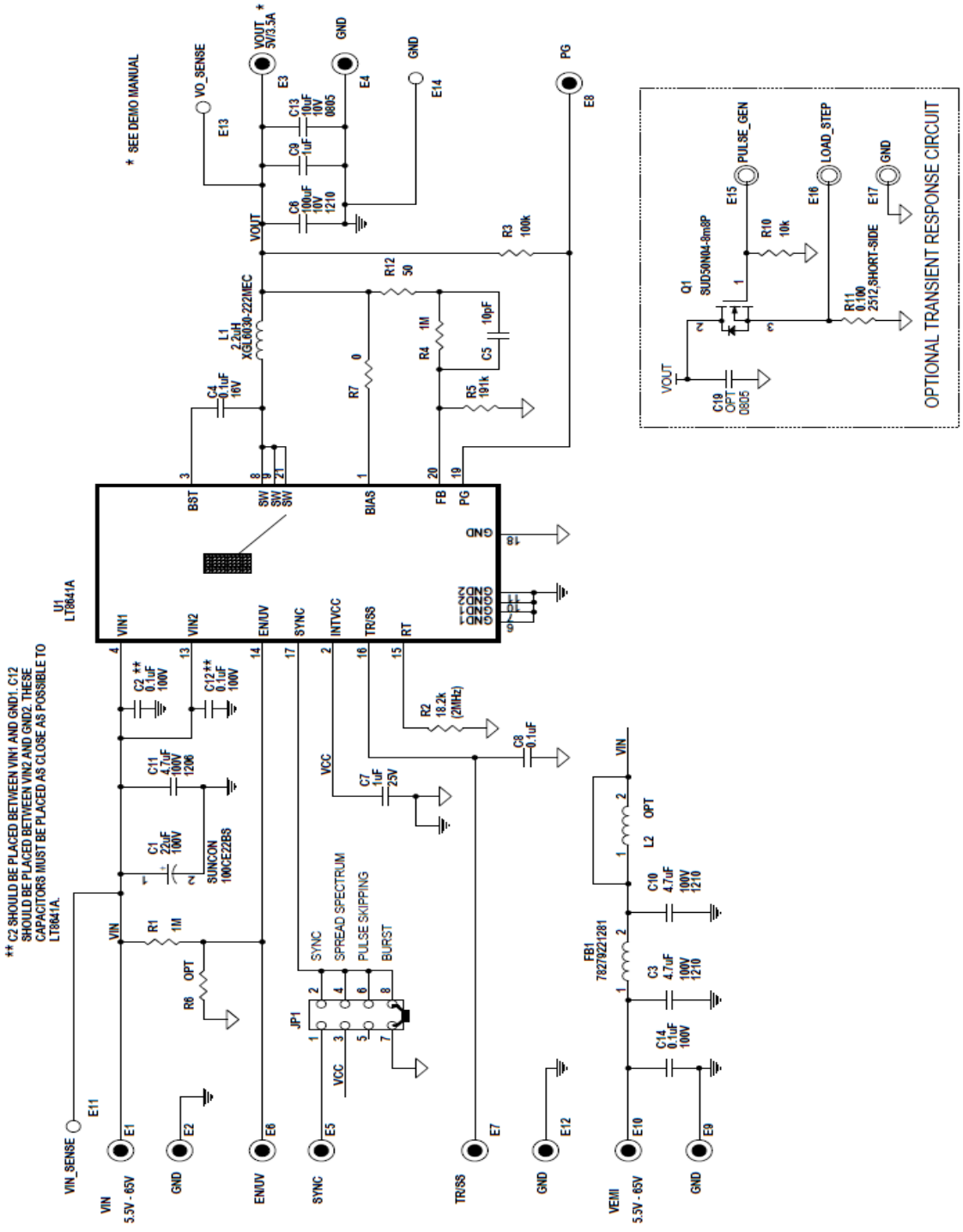


Figure 4. Scope Probe Placement for Measuring Input or Output Voltage Ripple

Bill of Materials

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
			Required Evaluation Kit 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, 1.0µF, 25V, 10%, 0603	MURATA, GRM188R71E105KA12D
6	1	C11	CAP., X7R, 4.7µF, 100V, 10% 1206	MURATA, GRM31CZ72A475ME11L
7	1	L1	IND., 2.2µH	COILCRAFT, XGL6030-222MEC
8	2	R1, R4	RES., CHIP, 1MEG, 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	U1	IC, REGULATOR, 20-QFN, UDC	ANALOG DEVICES, LT8641ARUDCM#WPBF
			Additional Evaluation Kit Components	
1	1	C1	CAP., ALUM 22µF 100V	SUN ELECT, 100CE22BS
2	2	C3, C10	CAP., X7S, 4.7µF, 100V, 10%, 1210	TDK, CGA6M3X7S2A475K200AB
3	1	C9	CAP., X7R, 1.0µF, 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 1206	WURTH, 78279221281
7	1	L2 (OPT.)	IND.,	
8	0	R6 (OPT.)	RES., 0603	
9	1	R7	RES., CHIP, 0, 1/10W, 1%, 0604	VISHAY, CRCW06030000Z0EA
10	1	R10	RES., CHIP, 10K, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
11	1	R11	RES., CHIP, 0.1Ω, 3W,1%,2512	SUSUMU, KRL3264E-C-R100-F-T1
12	1	R12	RES., CHIP, 50Ω, 1/10W, 1%, 0603	CRCW060350R0FKEA
13	1	Q1	MOSFET, N-CH,40V,14A, DPAK	VISHAY, SUD50N04-8M8P-4GE3
			Hardware for Evaluation Kit Only	
1	14	E2 to E10, E12, E15 to E17	TESTPOINT, TURRET, .094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	E1 (OPT.)	TESTPOINT, TURRET, .094"	
3	1	JP1	DOUBLE ROW HEADER 2 x 4 .079"	SULLINS NRPN042PAEN-RC
4	1	XJP1	SHUNT, .079" CENTER	SAMTEC 2SN-BK-G
5	4	MH1-MH4	STAND-OFF, NYLON 0.50" TALL	KEYSTONE, 8833 (SNAP ON)

Schematic Diagram



Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	05/23	Initial release	—

Mouser Electronics

Authorized Distributor

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EVAL-LT8641A-AZ