

General Description

The demonstration circuit EVAL-LT8624S-AZ is a 18V, 4A synchronous step-down Silent Switcher 3 with ultra-low noise, high efficiency, and power density featuring the LT8624S. The input voltage range of EVAL-LT8624S-AZ is 2.7V to 18V. The default demo board setting is 1.0V at 4A maximum DC output current. The LT8624S is a compact, ultra-low noise, ultra-low emission, high efficiency, and high speed synchronous monolithic stepdown switching regulator. The uniquely designed combination of the ultra-low noise reference and thirdgeneration Silent Switcher architecture enables the LT8624S to achieve both high efficiency and excellent wideband noise performance. Minimum on-time of 12ns allows high V_{IN} to low V_{OUT} conversion at high frequency.

Program the LT8624S switching frequency either through the oscillator resistor or external clock over a 300kHz to 6MHz range. The default frequency of demo circuit EVAL-LT8624S-AZ is 2MHz. The SYNC pin on the demo board is grounded by default for low ripple pulse skip mode operation. To synchronize to an external clock, move JP1 to SYNC and apply the external clock to the SYNC terminal. Select the forced continuous mode (FCM) respectively by moving the JP1 shunt. Figure 1 shows the efficiency of the circuit at 5V input and 12V input in the force continuous mode operation (input from V_{IN} terminal). Figure 2 shows the LT8624S temperature rising on the EVAL-LT8624S-AZ demo board under 3A and 4A load conditions.

The demo board has an EMI filter installed. This EMI filter can be included by applying the input voltage at the V_{IN_EMI} terminal. Figure 3 shows the EMI performance of the board. The red line in Radiated EMI Performance is the CISPR32 Class B limit. In addition to the excellent EMI performance, the regulator also features ultra-low noise over a wide frequency range, as shown in Figure 4.

The LT8624S data sheet gives a complete description of the part, including operation and application information. Read the data sheet in conjunction with this demo manual for demo circuit EVAL-LT8624S-AZ. The LT8624S is assembled in a 4mm x 3mm LQFN package with exposed ground pads for low thermal resistance. The layout recommendations for low EMI operation and maximum thermal performance are available in the data sheet section 'Low EMI PCB Layout and Thermal Considerations'.

Design files for this circuit board are available.

Performance Summary Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range V_{IN}		2.7		18	V
Output Voltage		0.992	1.0	1.008	V
Default Switching Frequency		1.93	2.0	2.07	MHz
Maximum Output Current	Derating is Necessary for Certain V_{IN} and Thermal Conditions	4			
Efficiency	$V_{IN} = 12\text{V}$ $f_{SW} = 2\text{MHz}$ $V_{OUT} = 1.0\text{V}$ at $I_{OUT} = 4\text{A}$		78		%

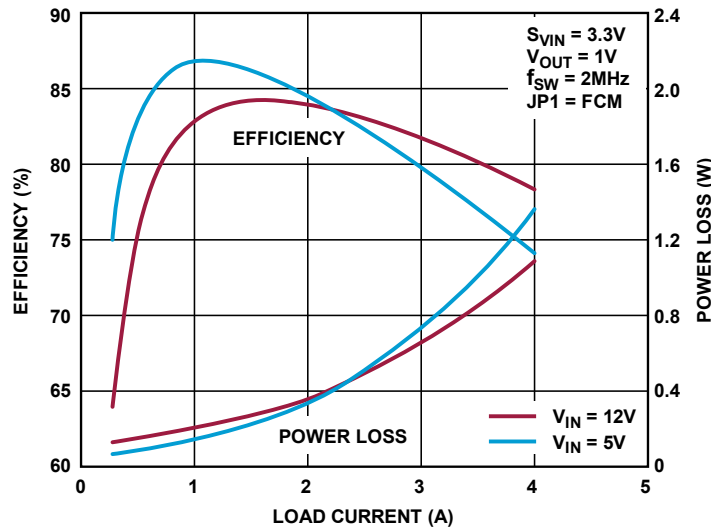


Figure 1. LT8624S Demo Circuit EVAL-LT8624S-AZ Efficiency vs. Load Current (Input from V_{IN} Terminal)

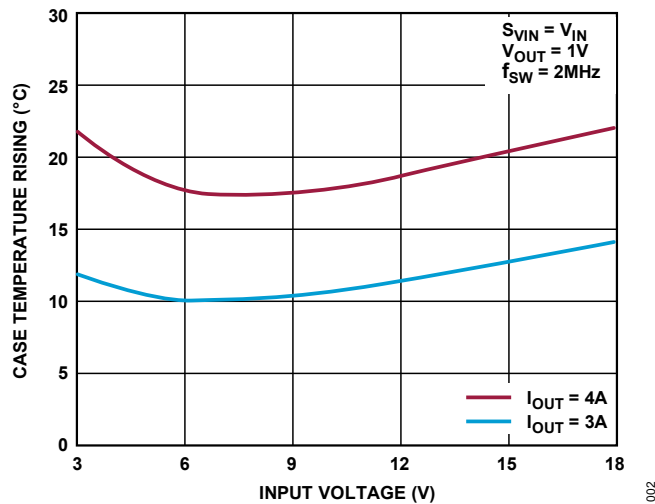
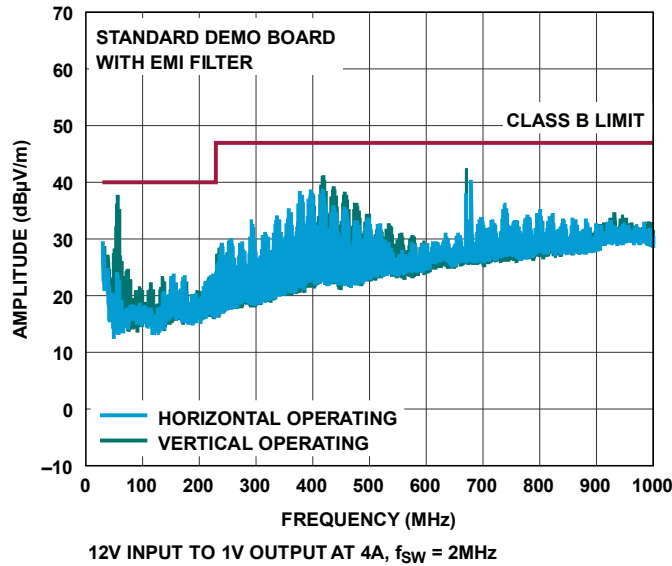
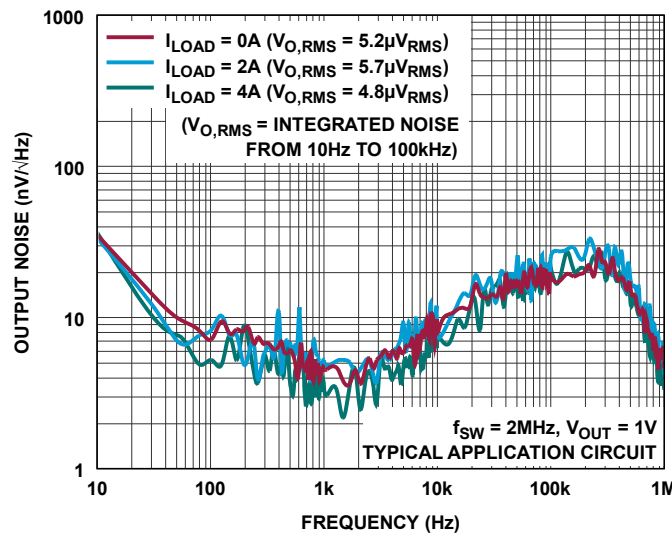


Figure 2. Temperature Rising vs. V_{IN}



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Figure 3. LT8624S Demo Circuit EVAL-LT8624S-AZ EMI Performance (12V Input to 1.0V Output at 4A, $f_{SW} = 2\text{MHz}$)



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Figure 4. LT8624S Data Sheet Typical Application Circuit Noise Spectral Density (12V Input to 1.0V Output, $f_{SW} = 2\text{MHz}$)

Quick Start Procedure

The demonstration circuit EVAL-LT8624S-AZ is easy to set up to evaluate the performance of LT8624S. See Figure 5 for proper equipment setup and follow these test procedures.

NOTE: When measuring the input or output voltage ripple, be careful 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. For input voltage ripple and remote output voltage ripple, measure them through the SMA connectors through VIN_SENSE and VO_SENSE. Figure 6 shows the output voltage ripple measured at the output capacitor C20 through the VO_SENSE SMA connector.

1. Place JP1 on the FCM position.
2. With power off, connect the input power supply to VIN (E1) and GND (E2).
3. With power off, connect the load from VOUT (E19) to GND (E20).

4. Connect the DMM between the input test points: VIN_SENSE (E3) and SENSE_GND (E4) to monitor the input voltage. Connect DMM between VO_SENSE (E10) and SENSE_GND (E11) to monitor the output voltage.
5. Turn on the power supply at the input.
6. Check for the proper output voltage (VOUT = 1V).
7. Once the input and output voltages are properly established, adjust the load current within the operating range of 0A to 4A maximum per channel. Observe the output voltage regulation, output voltage ripples, switching node waveform, load transient response, and other parameters.
8. Add an external clock to the SYNC terminal when using the SYNC function (JP1 on the SYNC position). Choose the RT resistor (R4) to set the LT8624S switching frequency at least 20% below the lowest SYNC frequency.

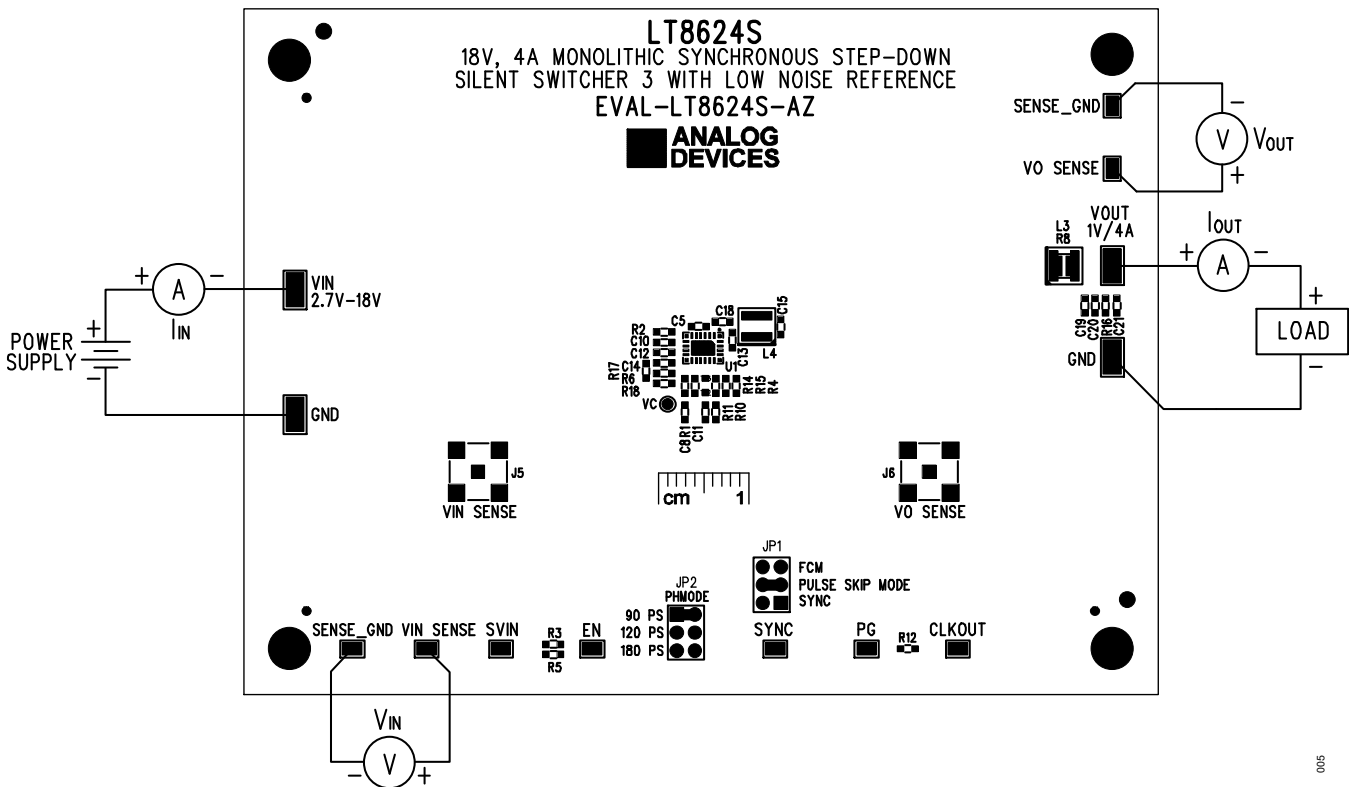


Figure 5. Proper Measurement Equipment Setup

Typical Performance Characteristics

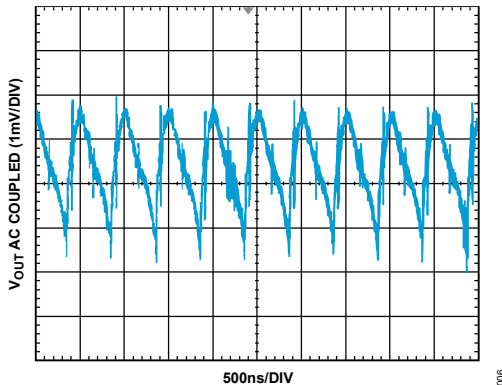


Figure 6. LT8624S Demo Circuit EVAL-LT8624S-AZ Output Voltage Ripple Measured Through J6 (12V Input, Remote Sense enabled, $I_{OUT} = 4A$, 200MHz BW)

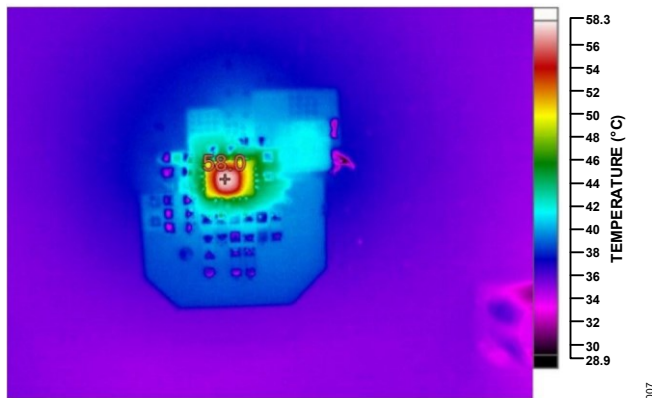


Figure 7. Thermal Performance at $V_{IN} = 12V$, $S_{VIN} = V_{IN}$, $f_{SW} = 2MHz$, $V_{OUT} = 1.0V$, $I_{LOAD} = 4A$, $T_A = 25^{\circ}C$

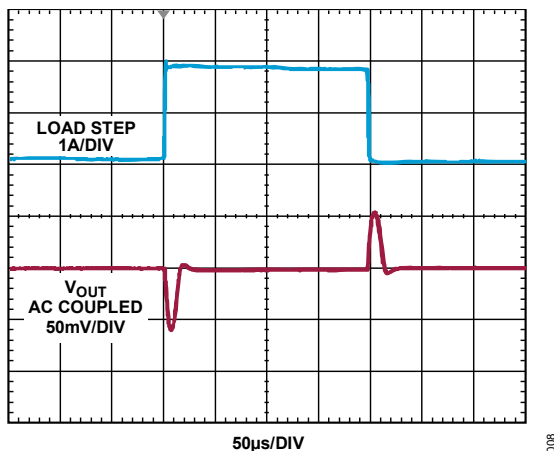


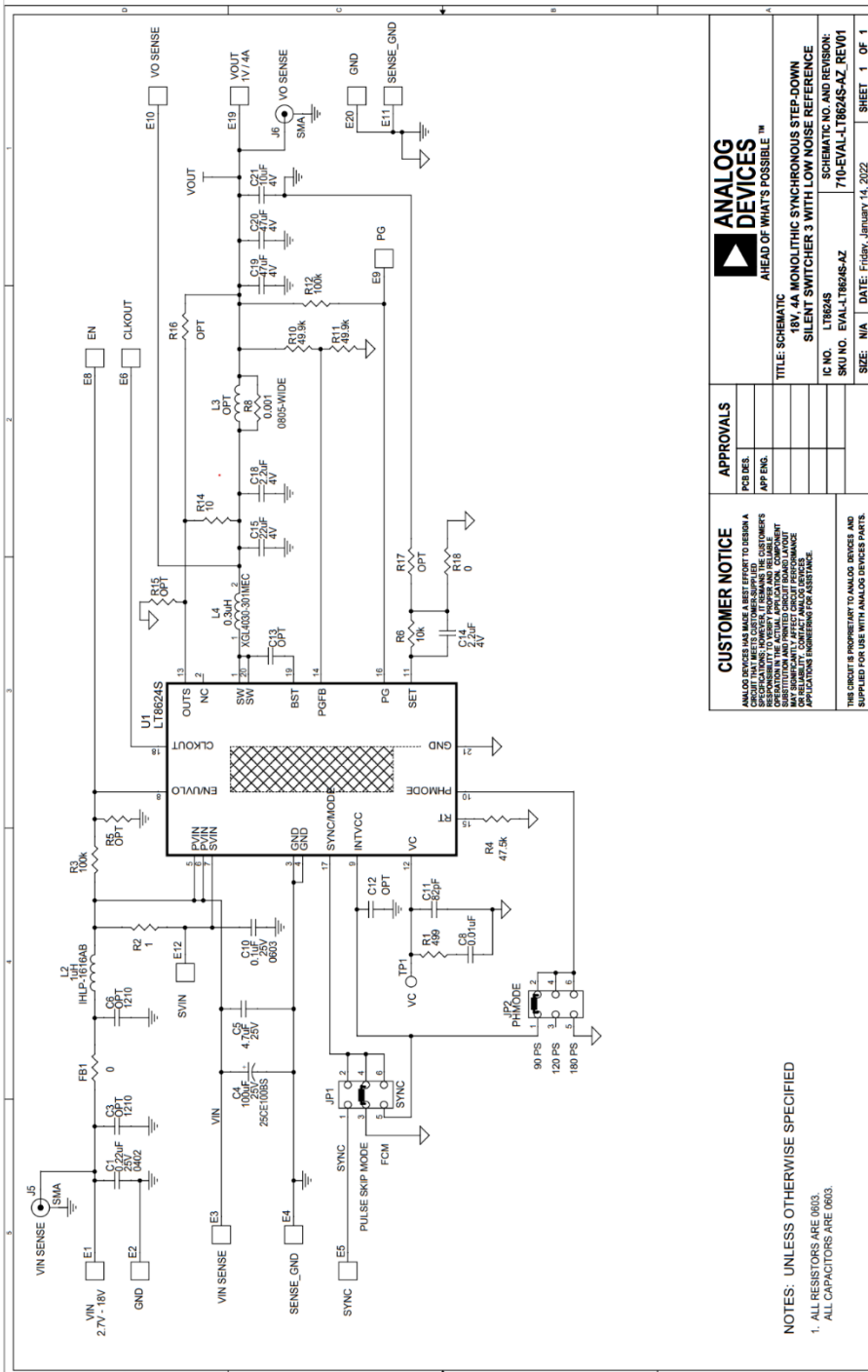
Figure 8. Transient Response with Load Steps 0A to 2A to 0A at $di/dt = 2A/\mu s$. V_{OUT} measured at C21.

LT8624S EV Kit Bill of Materials

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
REQUIRED CIRCUIT COMPONENTS				
1	1	C1	CAP., 0.22 μ F, X7R, 25V, 10%, 0402	TDK, CGA2B3X7R1E224K050BB
2	0	C3, C6	CAP., OPTION, 1210	
3	1	C4	CAP., 100 μ F, ALUM ELECT, 25V, 20%, 6.3mm x 7.7mm, CE-BS Series	SUN ELECTRONIC INDUSTRIES CORP, 25CE100BS
4	1	C5	CAP., 4.7 μ F, X5R, 25V, 10%, 0603	MURATA, GRM188R61E475KE15D
5	1	C8	CAP., 0.01 μ F, X7R, 50V, 10%, 0603	
6	1	C10	CAP., 0.1 μ F, X7R, 25V, 10%, 0603	AVX, 06035C103KAT2A
7	1	C11	CAP., 82pF, X7R, 50V, 10%, 0603	AVX, 06033C104KAT2A
8	0	C12, C13	CAP., OPTION, 0603	
9	2	C14, C18	CAP., 2.2 μ F, X7R, 6.3V, 10%, 0603, AEC-Q200	MURATA, GCM188R70J225KE22J
10	1	C15	CAP., 22 μ F, X7R, 4V, 20%, 0603	YAGEO, CC0805KKX7R5BB225
11	2	C19, C20	CAP., 47 μ F, X5R, 4V, 20%, 0603	MURATA, GRM188R60G476ME15D
12	1	C21	CAP., 10 μ F, X7S, 4V, 20%, 0603	TDK, C1608X7S0G106M080AB
13	4	E1, E2, E19, E20	TEST POINT, SILVER PLATE, PHOSPHOR BRONZE, 3.81mm x 2.03mm, 2.29mm H, SMT	TE CONNECTIVITY, 1625854-2
14	11	E3-E6, E8-E12	TEST POINT, 0805, 2mm x 1.25mm x 1.45mm, PROBE PAD, FOIL, VERT, SMT, NATURAL	WURTH ELEKTRONIK, 885012206006
15	2	FB1, R18	RES., 0 Ω , 1/10W, 0603, AEC-Q200	VISHAY, CRCW06030000Z0EA
16	2	J5, J6	CONN., RF/COAX, SMA JACK, FEMALE, 1 PORT, VERT, ST, SMT, 50 Ω , Au	MOLEX, 0732511350
17	2	JP1, JP2	CONN., HDR, MALE, 2mm x 3,2mm, VERT, ST, THT	WURTH ELEKTRONIK, 62000621121
18	1	L2	IND., 1 μ H, PWR, SHIELDED, 20%, 4A, 52.5m Ω , 1616AB, IHLP-01 Series	VISHAY, IHLP1616ABER1R0M01
19	1	L4	IND., 0.3 μ H, PWR, 20%, 21.2A, 3.4m Ω , SMD, AEC-Q200, SHIELDED	COILCRAFT, XGL4030-301MEC
20	1	LB1	LABEL SPEC, DEMO BOARD SERIAL NUMBER	BRADY, THT-96-717-10
21	4	MP1-MP4	STANDOFF, NYLON, SNAPON, 0.375"	KEYSTONE, 8832
22	1	PCB1	PCB, EVAL-LT8624S-AZ	ADI APPROVED SUPPLIER, 600-EVAL-LT8624S-AZ
23	1	R1	RES., 499 Ω , 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603499RFKEA
24	1	R2	RES., 1 Ω , 1%, 1/10W, 0603, AEC-Q200	NIC, NRC06F1R00TRF
25	2	R3, R12	RES., 100k Ω , 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW0603100KFKEA
26	1	R4	RES., 47.5k Ω , 1%, 1/10W, 0603	VISHAY, CRCW060347K5FKEA
27	0	R5, R15, R16, R17	RES., OPTION, 0603	
28	1	R6	RES., 10k Ω , 1%, 1/10W, 0603, AEC-Q200	VISHAY, CRCW060310K0FKEA
29	1	R8	RES., 0 Ω , 3/4W, 1206, PULSE PROOF, HIGH PWR, AEC-Q200	VISHAY, CRCW12060000Z0EAHP
30	2	R10, R11	RES., 49.9k Ω , 1%, 1/10W, 0603	VISHAY, CRCW060349K9FKEA

31	1	R14	RES.,10Ω, 1%, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
32	1	U1	IC, SYNC. STEP-DOWN SILENT SWITCHER,LQFN-20	ANALOG DEVICES, LT8624SAV#PBF
33	2	XJP1, XJP2	CONN., SHUNT, FEMALE, 2-POS,2mm	WURTH ELEKTRONIK, 60800213421

LT8624S EV Kit Schematic



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APPROVALS

PCB DES.	
APP ENG.	

TITLE: SCHEMATIC
18V, 4A MONOLITHIC SYNCHRONOUS STEP-DOWN SILENT SWITCHER 3 WITH LOW NOISE REFERENCE

IC NO. LT8624S
SKU NO. EVAL-LT8624S-AZ

SCHEMATIC NO. AND REVISION:
710-EVAL-LT8624S-AZ_REV01

DATE: Friday, January 14, 2022

THE CIRCUIT IS PROPRIETARY TO ANALOG DEVICES AND SUPPLIED FOR USE WITH ANALOG DEVICES PARTS.

SHEET 1 OF 1

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
A	05/24	Initial release for open market	—

