Evaluation Board User Guide

EVAL-LT8342-AZ

Evaluates: LT8342 in 24V Output Voltage Application

General Description

The EVAL-LT8342-AZ evaluation board provides a proven design to evaluate the LT8342, a 40V, 9A, Low I_Q Synchronous Step-Up *Silent Switcher*™ with Input Disconnect and PassThru™. The application circuit is configured to demonstrate optimum performance and component size. Using the board layout example, optimized for Electromagnetic Interference (EMI), and thermal performance, will help ensure the designer sees similar performance in their system.

The evaluation board is configured to run at 2MHz with a 24V output voltage from an input voltage range of 6V to 20V and deliver up to 3A load current when V_{IN} is 12V.

The evaluation board features an adjustable input undervoltage-lockout, external clock synchronization, thermal shutdown, selectable mode of operation, input disconnect, and PassThru.

The *LT8342 converter data sheet* provides a complete description of the part that should be read in conjunction with this user guide before operating the evaluation board.

Features and Benefits

- Input Voltage Range: 6V to 20V
- 24V Output Voltage
- Up to 3A Load Current at 12V Input
- 2MHz Switching Frequency
- High 95.1% Efficiency (V_{IN} = 12V, I_{OUT} = 2.5A)
- Enable/UVLO Input, Resistor-Programmable UVLO Threshold
- Selectable Mode of operation (See *Table 1* for more details)
- Output Short Protection/Inrush Current Reduction
- Input Disconnect
- PassThru Operation
- External Frequency Synchronization
- External Compensation
- Overtemperature Protection
- Proven Printed Circuit Board (PCB) Layout
- Fully Assembled and Tested

***Ordering Information* appears at end of data sheet.**

Quick Start

Required Equipment

- One 20V, 12A DC Power Supply
- Digital Multimeters (DMM)
- Load Resistors Capable of Sinking up to 3A at 24V Output.

Procedure

The evaluation board is fully assembled and tested. Use the following steps below to verify the board operation.

Caution: Do not turn on power supply until all connections are completed.

- Disable the power supply and set the input-power supply at a voltage between 6V to 20V.
- Connect the positive terminal of the power supply to the VIN_EMI PCB pad and the negative terminal to the nearest GND PCB pad.
- Connect the positive terminal of the load to the VOUT PCB pad and the negative terminal to the nearest GND PCB pad.

Caution: Do not enable the Load until power supply is turned on.

- Connect the DMM across the VOUT PCB pad and the nearest GND PCB pad.
- Verify that the shunt is installed across pins on jumper JP1 to program the desired mode. See *Table 1* for more details.
- Verify that the shunt is installed properly across pins 1–2 on jumper JP2.
- Verify that the shunt is installed properly across pins 1–2 on jumper JP3.
- Turn on the input-power supply.
- Enable the load.
- Verify that the DMM displays the expected terminal voltage with respect to GND.

One Analog Way, Wilmington, MA 01887-2356, U.S.A. | Tel: 781.329.4700

EVAL-LT8342-AZ Configuration

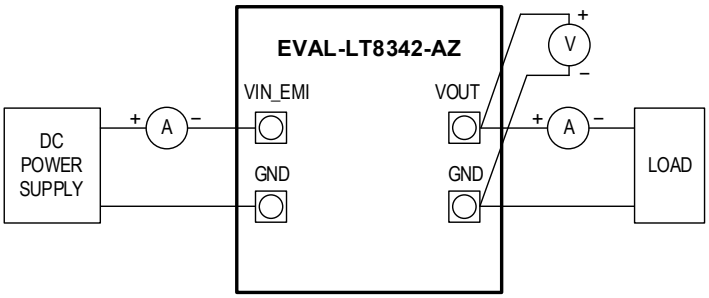


Figure 1. EVAL-LT8342-AZ Board Connections

Typical Performance Characteristics

T_A = 25°C, all measurements are in reference to EVAL-LT8342-AZ Schematic. Source connected between VIN_EMI and GND and Load connected between V_{OUT} and GND, unless otherwise noted.

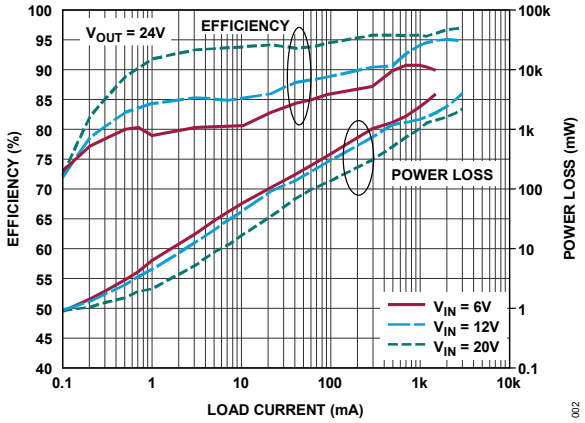


Figure 2. Efficiency and Power Loss vs Output Current (Burst Mode)

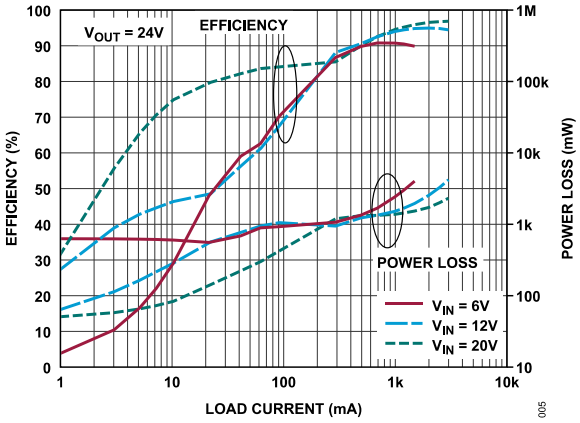


Figure 3. Efficiency and Power Loss vs Output Current (Pulse Skip Mode)

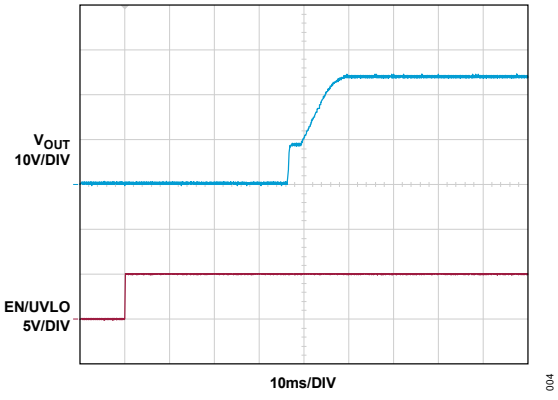


Figure 4. Soft Start with Input Disconnect. V_{IN} = 9V

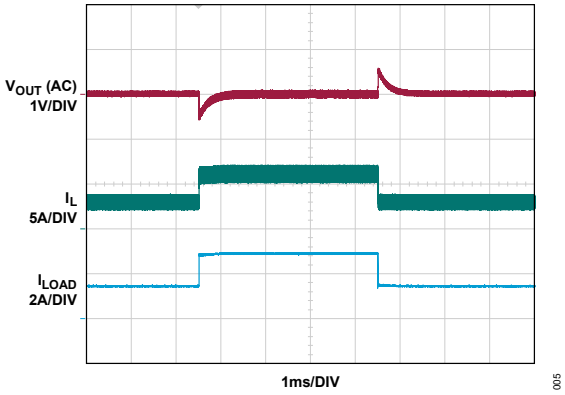


Figure 5. Load Transient Response: 1.5A to 3A. V_{IN} = 12V

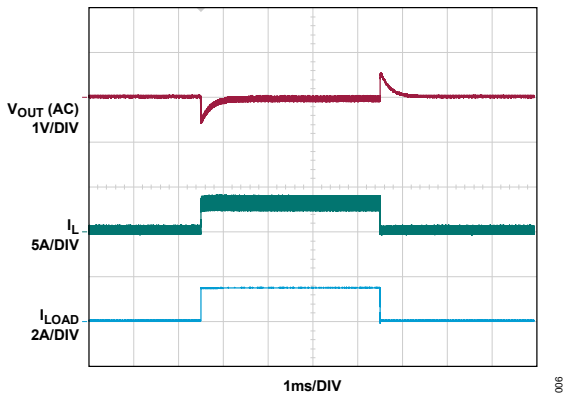


Figure 6. Load Transient Response: 50mA to 1.5A. V_{IN} = 12V, (Pulse Skip Mode)

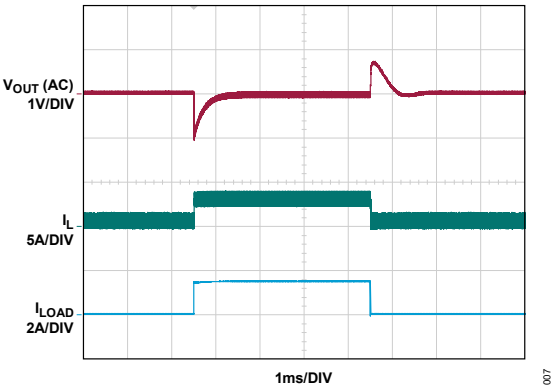


Figure 7. Load Transient Response: 50mA to 1.5A. V_{IN} = 12V, (Burst Mode)

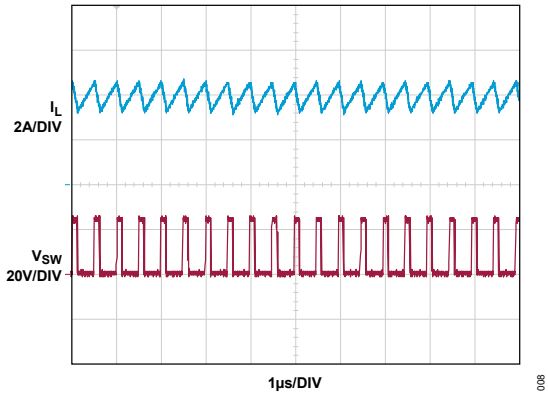


Figure 8. Switching Waveforms, Full-Frequency PWM Operation. V_{IN} = 6V, I_{LOAD} = 900mA

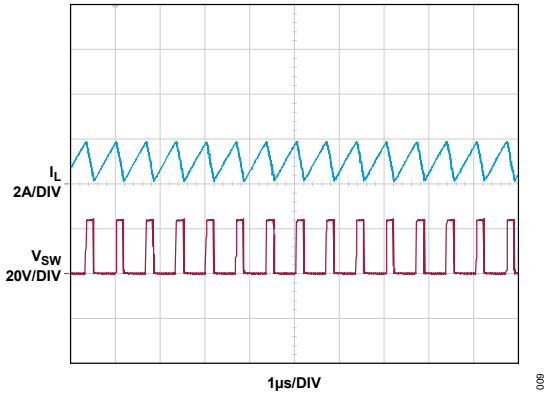


Figure 9. Switching Waveforms, Continuous Burst Mode Operation. SYNC/MODE = 0V, V_{IN} = 6V, I_{LOAD} = 230mA

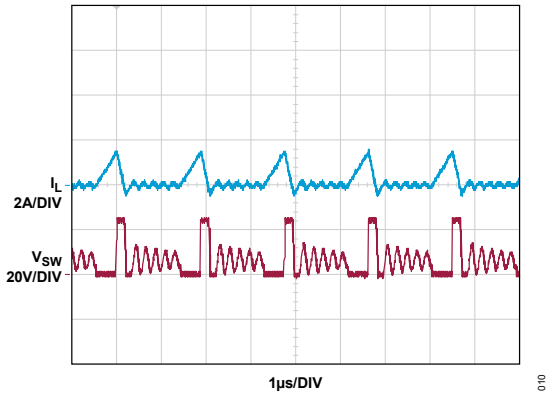


Figure 10. Switching Waveforms, Discontinuous Burst Mode Operation. SYNC/MODE = 0V, V_{IN} = 6V, I_{LOAD} = 50mA

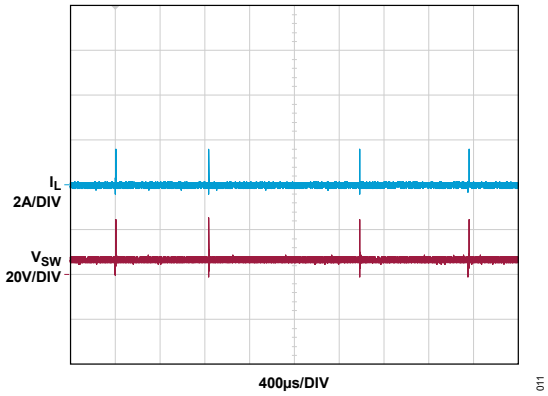


Figure 11. Switching Waveforms, Light Load I_Q Burst Mode Operation. SYNC/MODE = 0V, V_{IN} = 6V, I_{LOAD} = 0A

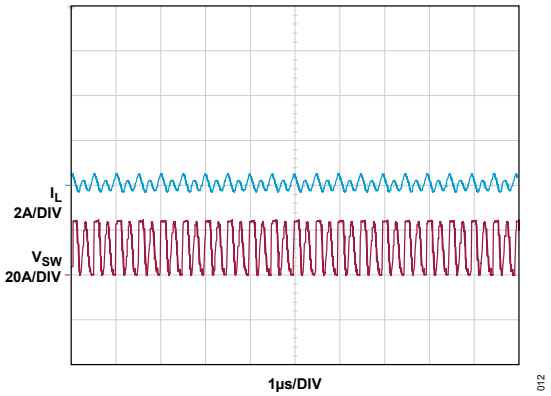


Figure 12. Switching Waveforms, Discontinuous Pulse-Skipping Mode. SYNC/MODE open, V_{IN} = 12V, I_{LOAD} = 0A

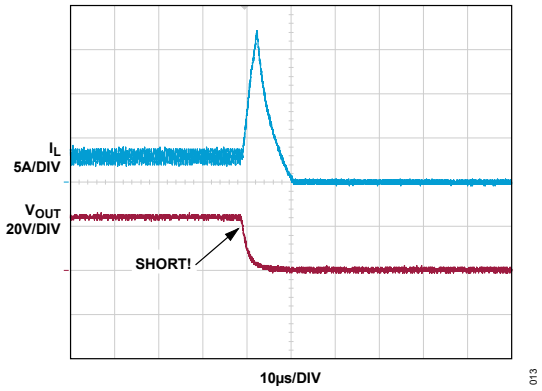


Figure 13. Output Short Circuit Protection. V_{IN} = 9V

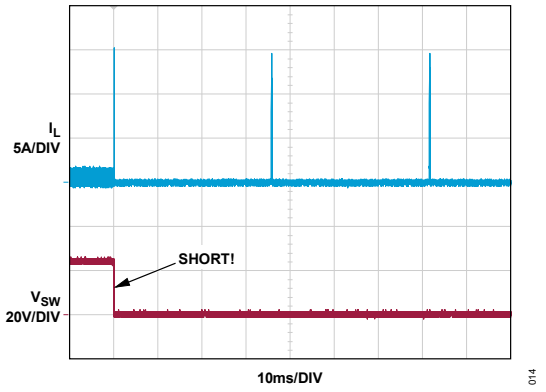


Figure 14. Hiccup during Output Short Circuit. V_{IN} = 9V

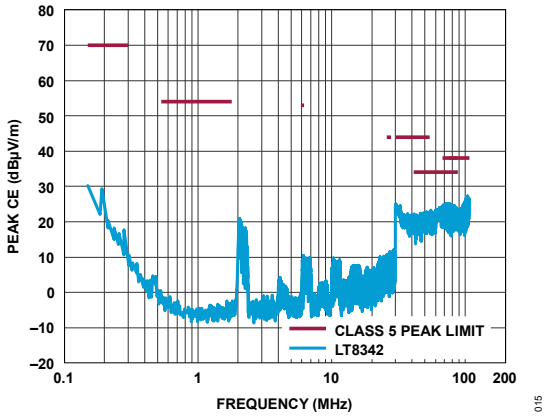


Figure 15. Conducted EMI Performance (CISPR 25 Class 5 Peak). V_{IN} = 12V, V_{OUT} = 24V, I_{LOAD} = 3A. SSFM ON. f_{SW} = 2MHz to 2.3MHz

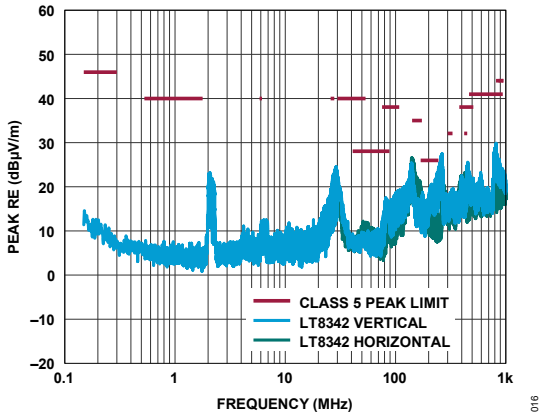


Figure 16. Radiated EMI Performance (CISPR 25 Class 5 Peak). V_{IN} = 12V, V_{OUT} = 24V, I_{LOAD} = 3A. SSFM ON. f_{SW} = 2MHz to 2.3MHz

Detailed Description

The EVAL-LT8342-AZ evaluation board is designed to demonstrate the salient features of LT8342, a 40V, 9A, Low I_Q Synchronous Step-Up Silent Switcher with Input Disconnect and PassThru. The evaluation board is preset for 24V output from 6V to 20V input and can deliver load current up to 1.5A at 6V input voltage and up to 3A at 12V input voltage with 2MHz switching frequency.

Enable/Undervoltage (EN/UVLO) Programming

The evaluation board offers an adjustable input turn-on/-off thresholds. UVLO is programmed using resistors R3 and R4. The V_{IN} rising threshold for enabling the converter is set to 5.44V (typ), and the V_{IN} falling threshold to disable the converter is set to 5.11V (typ). Refer to the *Programming V_{IN} Turn-On and Turn-Off Thresholds with the EN/UVLO Pin* section in the *LT8342 data sheet* for more details.

MODE Selection and External Clock Synchronization

The LT8342 supports five different modes of operation: Pulse Skip Mode, Pulse Skip Mode with Spread Spectrum Modulation (SSFM), Burst Mode, Burst Mode with SSFM, and Pulse Skip Mode with External Clock Synchronization. See *Table 1* for Jumper JP1 settings.

The converter's internal oscillators can be synchronized to an external clock signal on the MODE/SYNC pin. By providing a digital clock signal to the SYNC/MODE pin, the IC operates with SYNC clock frequency and automatically enters Pulse Skip operation at light load. If this feature is used, an RT resistor should be chosen to program the switching frequency close to the external clock frequency. Refer to the *Programming Switching Frequency and Synchronization* section in the *LT8342 data sheet* for more details.

Table 1. Mode Jumper Description (JP1)

SHUNT POSITION	MODE/SYNC PIN	OPERATING MODE
1–2*	Float	Pulse Skip Mode of Operation
3–4	Connected to $INTV_{CC}$	Pulse Skip + SSFM Mode of Operation
5–6	Connected to GND	Burst Mode of Operation
7–8	Connected to 100kΩ to GND	Burst + SSFM Mode of Operation
9–10	Connected to External Clock	Synchronized to External Clock

**Default Position*

Programming Switching Frequency

The switching frequency of the EVAL-LT8342-AZ can be programmed from 300kHz to 3MHz by using a resistor connected from the RT pin to GND. Resistor R6 programs the desired switching frequency. To optimize performance and component size in the evaluation board, a 2MHz switching frequency has been chosen. Refer to the *Programming Switching Frequency and Synchronization* section of the *LT8342 data sheet* to choose different values of resistors for programming the required switching frequency.

Programming the Output Voltage

The LT8342 supports an adjustable output voltage of up to 36V. The output voltage can be programmed using internal feedback or external feedback. EVAL-LT8342-AZ evaluation board is configured to 24V output using internal feedback, Shunt connected between position 1-2 in JP2, and Shunt connected between position 1-2 in JP3. Refer to the *Programming the Output Voltage* section in the *LT8342 data sheet* for more details.

Input Capacitor Selection

The input capacitors, C5 and C23, serve to reduce current peaks drawn from the input power supply and reduce the switching frequency ripple at the input. Refer to the *Input Capacitor Selection* section in the *LT8342 data sheet* to choose input capacitance. The input capacitors C5 is chosen as 10µF/50V/X7R/1210 and C23 is chosen as 1µF/50V/X5R/0402.

Output Capacitor Selection

The output capacitors C3 and C4 are chosen as 10µF/50V/X7R/1210. Refer to the *Output capacitor selection* section in the *LT8342 data sheet* for more details.

Hot Plug-In and Long input cables

The EVAL-LT8342-AZ evaluation board provides optional electrolytic capacitor C7 (33µF/50V) to dampen input voltage peaks and oscillations arising during hot-plug-in and/or due to long input cables. This capacitor limits the peak voltage at the input of the DC-DC converter when the evaluation board is powered directly from a precharged capacitive source or an industrial backplane PCB. Long input cables between an input-power source and the evaluation board circuit can cause input-voltage oscillations due to the inductance of the cables. The equivalent series resistance (ESR) of the electrolytic capacitor helps damp out the oscillations caused by long input cables.

Electromagnetic Interference (EMI)

Compliance with conducted emissions (CE) standards requires an EMI filter at the input of a switching power converter. The EMI filter attenuates high-frequency currents drawn by the switching power converter, and limits the noise injected back into the input power source.

The use of EMI filter components as shown in the evaluation board schematic results in lower conducted emissions, below CISPR25 Class 5 limits. The PCB layout is also designed to limit radiated emissions from switching nodes of the power converter, resulting in radiated emissions below CISPR25 Class 5 limits. Further, capacitors placed near the input of the board help in attenuate high-frequency noise. EMI filters may not be necessary for all applications. For a lower parts count and BOM cost EMI filters can be removed.

Input Disconnect, Inrush Current reduction and Output short-circuit Protection

EVAL-LT8342-AZ evaluation board is configured to demonstrate Input Disconnect, Inrush current reduction, and short circuit protection using N-Channel MOSFET Q1, Sense resistor R7, and diode D1 to clamp negative voltage across the Gate of Q1. R7 is selected as 3mΩ to limit the current to 15A (Typ). Q1 is selected as NVTFS5C453NL (40V, 3.1mΩ). Refer to the *Output Short-Circuit Protection* section in the *LT8342 data sheet* for more details.

PreBoost

The evaluation board offers a programmable PreBoost feature. See *PreBoost Jumper* Description (JP4) for jumper setting JP4. Refer to the *PREBOOST pin description* section in the *LT8342 data sheet* for more details.

Table 2. PreBoost Jumper Description (JP4)

SHUNT POSITION	PREBOOST PIN	PG PIN STATUS
1–2*	Connected to GND	PG pin pulled high when V_{OUT} within ±10% of the target voltage
2–3	Connected to $INTV_{CC}$	PG pin pulled high when V_{OUT} higher than -10% of the target voltage

**Default Position*

Ordering Information

PART	TYPE
EVAL-LT8342-AZ	Evaluation Board

Component Suppliers

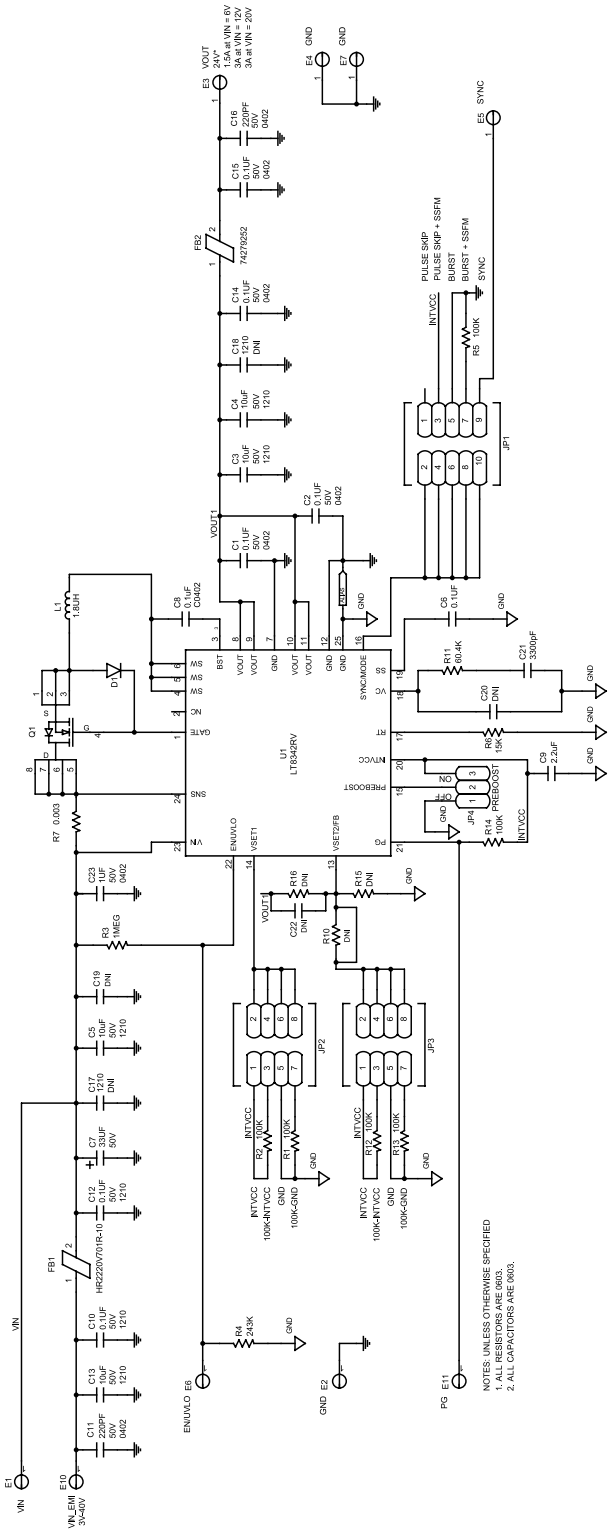
SUPPLIER	WEBSITE
Murata Americas	www.murata.com
Coilcraft	www.coilcraft.com
Vishay	www.vishay.com
Panasonic Corp.	www.panasonic.com
Yageo	www.yageo.com
TDK	www.tdk.com
Würth Electronik	www.we-online.com
Nexperia	www.nexperia.com
Onsemi	www.onsemi.com
Thin Film Technology	www.thin-film.com
Laird	www.laird.com

Note: *When contacting these component suppliers, indicate that the LT8342 is being used.*

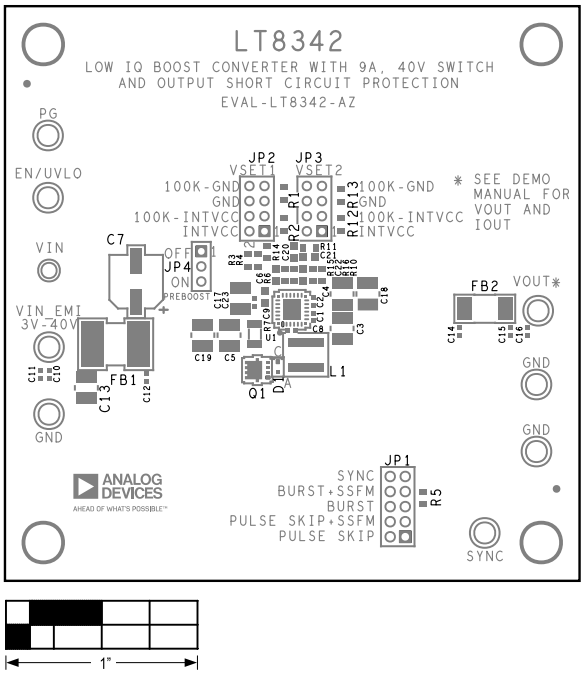
EVAL-LT8342-AZ Bill of Materials

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
REQUIRED EVALUATION KIT COMPONENTS				
1	6	C1, C2, C10, C12, C14, C15	CAP., X7R, 0.1µF, 50V, 10%, 0402	MURATA, GRM155R71H104KE14J
2	2	C11, C16	CAP., X7R, 220pF, 50V, 10%, 0402	WÜRTH ELEKTRONIK, 885012205057
3	4	C3, C4, C5, C13	CAP., X7R, 10µF, 50V, 10%, 1210	MURATA, GRM32ER71H106KA12L
4	1	C21	CAP., X7R, 3300pF, 50V, 10%, 0603	TDK, CGA3E2X7R1H332K080AA
5	1	C23	CAP., X5R, 1µF, 50V, 10%, 0402	MURATA, GRM155R61H105KE05
6	1	C6	CAP., X7R, 0.1µF, 50V, 10%, 0603	WÜRTH ELEKTRONIK, 885012206095
7	1	C7	CAP., ALUM, 33µF, 50V, 20%	PANASONIC, EEH-ZC1H330XP
8	1	C8	CAP., X7R, 0.1µF, 25V, 10%, 0402	MURATA, GRM155R71E104KE14D
9	1	C9	CAP., X7R, 2.2µF, 10V, 10%, 0603	MURATA, GRM188R71A225KE15D
10	1	D1	LOW LEAKAGE DIODE, 85V, 0.2A, SOD523	NEXPERIA, BAS716
11	1	FB1	FERRITE BEAD, 700Ω @100MHz, 0.010Ω, 8A, 2220	LAIRD, HR2220V701R-10
12	1	FB2	FERRITE BEAD, 880Ω @100MHz, 0.035Ω, 4A, 1812	WÜRTH ELEKTRONIK, 74279252
13	1	L1	IND., 1.8UH, 15.3A, 0.0078Ω	COILCRAFT, XGL5050-182MEC
14	1	Q1	N-CH MOSFET., 40V, 3.1mΩ, 8-WDFN	ONSEMI, NVTFS5C453NLWFTAG
15	6	R1, R2, R5, R12, R13, R14	RES., CHIP, 100kΩ, 1%, 1/10W, 0603	YAGEO, RC0603FR-07100KL
16	1	R11	RES., CHIP, 60.4kΩ, 1%, 1/10W, 0603	VISHAY, CRCW060360K4FKEA
17	1	R3	RES., CHIP, 1MΩ, 1%, 1/10W, 0603	VISHAY, CRCW06031M00FKEA
18	1	R4	RES., CHIP, 243kΩ, 1%, 1/10W, 0603	VISHAY, CRCW0603243KFKEA
19	1	R6	RES., CHIP, 15kΩ, 1%, 1/10W, 0603	VISHAY, CRCW060315K0FKEB
20	1	R7	RES., CHIP, 0.003Ω, 1%, 1W, 1206	THIN FILM TECHNOLOGY, D1MPC1206DR003FF-T5
21	1	U1	IC, 40V, 9A, LOW I_Q SYNCHRONOUS STEP-UP SILENT SWITCHER WITH INPUT DISCONNECT AND PassThru	ANALOG DEVICES, LT8342RV#PBF
HARDWARE FOR EVALUATION KIT ONLY				
1	8	E2, E3, E4, E5, E6, E7, E10, E11	TESTPOINT, TURRET, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	E1	TESTPOINT, TURRET, 0.064"	MILL-MAX, 2308-2-00-80-00-00-07-0
3	1	JP1	CONN-PCB 2MM P DIL	SAMTEC INC., TMM-105-01-F-D
4	2	JP2, JP3	CONN-PCB 8POS MALE HDR, DUAL ROW	WÜRTH ELEKTRONIK, 62000821121
5	1	JP4	CONN-PCB 3POS MALE HDR	WÜRTH ELEKTRONIK, 62000311121
6	3	C17, C18, C19	OPEN	PACKAGE OUTLINE 1210
7	2	C20, C22	OPEN	PACKAGE OUTLINE 0603
8	3	R10, R15, R16	OPEN	PACKAGE OUTLINE 0603

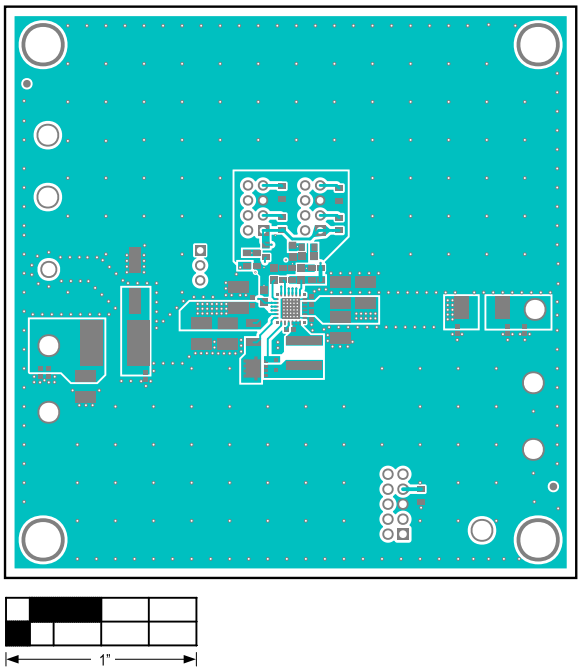
EVAL-LT8342-AZ Schematic



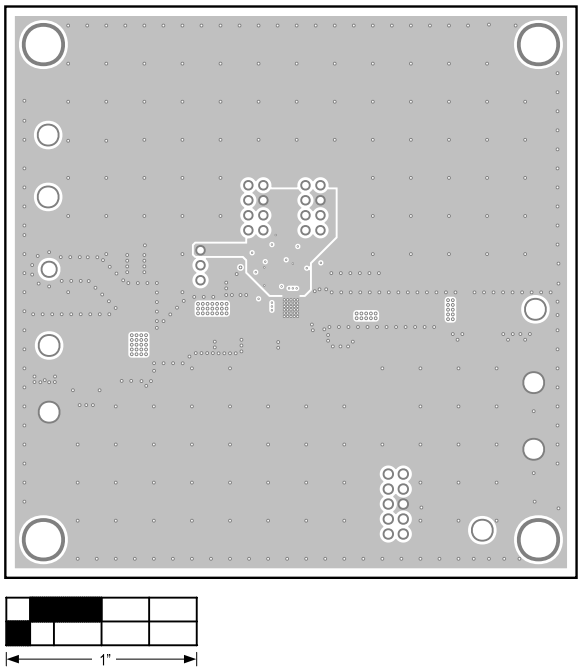
EVAL-LT8342-AZ PCB Layout



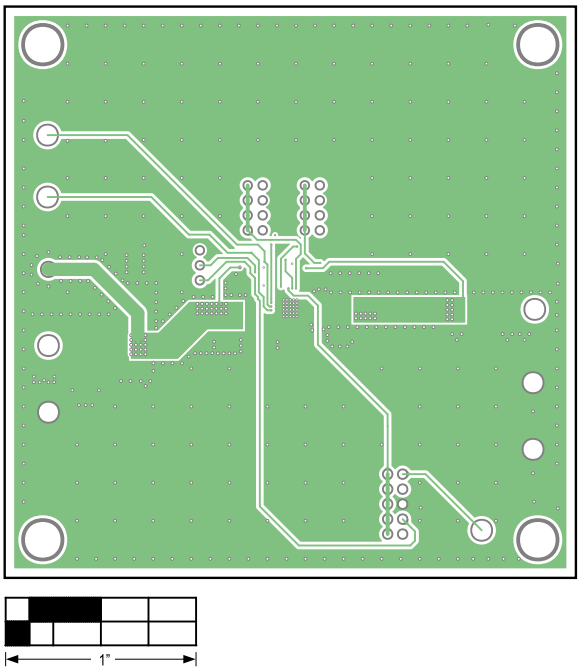
EVAL-LT8342-AZ—Top Silkscreen



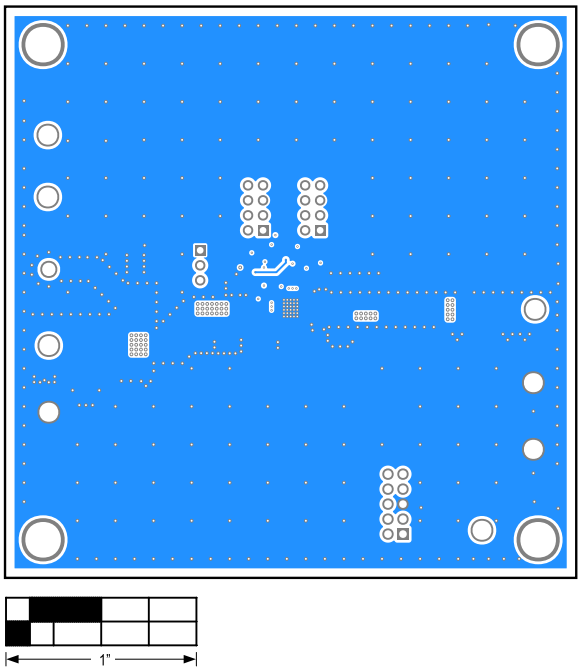
EVAL-LT8342-AZ PCB Layout—Layer 1



EVAL-LT8342-AZ PCB Layout—Layer 2



EVAL-LT8342-AZ PCB Layout—Layer 3



EVAL-LT8342-AZ PCB Layout—Layer 4

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/24	Initial Release	—

Notes

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Analog Devices Inc.:

EVAL-LT8342-AZ