

LT8374

60V, 1.2A Synchronous Step-Down LED Driver

DESCRIPTION

Evaluation board EVAL-LT8374-AZ is a synchronous step-down LED driver featuring the [LT[®]8374](#). It drives up to 36V of LEDs at 1.2A when the EMIVIN terminal is between 42V and 57V. EVAL-LT8374-AZ runs at 330kHz switching frequency and features options for spread spectrum modulation (SSFM) or external synchronization.

The LT8374 has an input voltage range of 6.5V to 60V. It features 60V synchronous internal power switches for high efficiency and small solution size. The switching frequency of LT8374 is fixed at 330kHz, and the device can be synchronized with an external clock source or configured with internal SSFM for low EMI. With SSFM enabled, LT8374 modulates its switching frequency between 310kHz and 440kHz to reduce switching emissions. EVAL-LT8374-AZ includes a SYNC/SSFM jumper to configure the LT8374 for either external synchronization, SSFM, or set to normal operation.

The LT8374 can be analog dimmed by applying a DC voltage between 1.25V and 250mV to the CTRL pin. An internal 20 μ A current source allows for a single resistor connected between CTRL pin and GND to provide this voltage. Alternatively, the LT8374 can be analog dimmed by applying a 15kHz to 200kHz PWM signal with a duty cycle between 12.5% to 62.5% to the CTRL pin. For higher resolution LED brightness control, a 100Hz to 200Hz PWM signal can be applied to the CTRL pin.

Small ceramic input and output capacitors are used to save space and cost. This evaluation board is designed with high frequency capacitors placed close to the IC's V_{IN} pins to form a compact switching hot loop for best EMI performance. Ferrite bead filters placed at the input and output help further reduce switching emissions. For

best efficiency, the EMI filters at the input and output can be removed. Please follow the recommended layout and the four-layer PCB thickness of EVAL-LT8374-AZ for optimal performance.

The LT8374 features overvoltage protection (OVP) which uses the IC's constant voltage regulation loop to regulate the output to approximately 40V in the case of an OPENLED event. A single resistor connecting V_{OUT} to FB provides this regulation setpoint. Both LED current and output overvoltage protection (OVP) can all be adjusted with simple modifications to EVAL-LT8374-AZ.

The LT8374 also features optional internal compensation options for reduced component count designs. To utilize the internal compensation options, the external compensation components must be removed and the V_C pin must be left floating. With external compensation components removed, the CAP pin can either be left floating or connected to GND to select between the two internal compensation options. EVAL-LT8374-AZ is configured with optimized external compensation network by default and includes a jumper for selecting between the two internal and external compensation configurations.

The LT8374 data sheet gives a complete description of the device, its operation, and applications information. The data sheet must be read in conjunction with this demo manual for evaluation board EVAL-LT8374-AZ. The LT8374 is assembled in a 16-pin plastic QFN package with a thermally enhanced exposed ground pad. Proper board layout is essential for maximum performance. See Designing the Printed Circuit Board section in the data sheet.

[Design files for this circuit board are available.](#)

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BOARD PHOTO

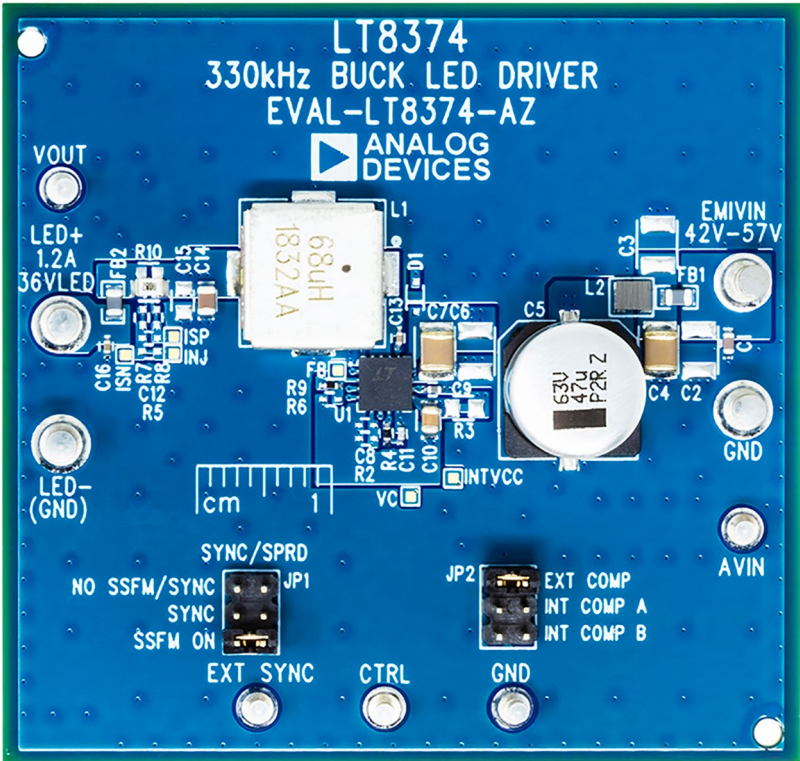


Figure 1. EVAL-LT8374-AZ Demo Board

PERFORMANCE SUMMARY Specifications are at $T_A = 25^{\circ}\text{C}$

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage $EMIV_{IN}$ Range	Operating	42		57	V
Switching Frequency (f_{SW})	JP1 = NO SSFM/SYNC	310	330	350	kHz
Spread Spectrum (SSFM) Range	JP1 = SSFM ON	310		440	kHz
I_{LED}	$R1 = 0.082\Omega$, $42V < EMIV_{IN} < 57V$, $V_{LED} \leq 36V$		1.2		A
Open LED Voltage V_{OUT} (OVP)	$R9 = 732k$		40		V
Typical Efficiency	$V_{IN} = 50V$, $V_{LED} = 36V$, $I_{LED} = 1.2A$		96		%
Peak Current Limit		2	2.2	2.5	A

QUICK START PROCEDURE

Evaluation board EVAL-LT8374-AZ is easy to set up to evaluate the performance of the LT8374. Follow the procedure below.

1. With power off, connect a string of LEDs that will run with forward voltage less than or equal to 36V at 1.2A to the LED+ and LED- turrets on the PCB as shown in Figure 2.
2. Set JP2 to EXT COMP to enable the external compensation populated on EVAL-LT8374-AZ. Set JP1 to NO SSFM/SYNC to run without SSFM.
3. With power off, connect the input power supply to the EMIVIN and GND turrets. Make sure that the DC input voltage will not exceed 60V.
4. Turn the input power supply on and make sure the voltage is between 42V and 57V for proper operation at max LED current.
5. Observe the LED string running at the programmed LED current.
6. To change the brightness with analog dimming, attach a DC voltage source to the CTRL terminal and set the voltage between 0.25V and 1.25V. Connect a resistor from CTRL pin to GND to set this voltage.
7. Alternatively, analog dimming can be performed by applying an external 25kHz to 200kHz PWM signal with duty cycle between 12.5% and 62.5% to the CTRL terminal.
8. To change the brightness with external PWM dimming, attach a 100Hz to 200Hz PWM waveform with varying duty cycle to the CTRL terminal.
9. To enable spread spectrum frequency modulation, set JP1 to SSFM ON.

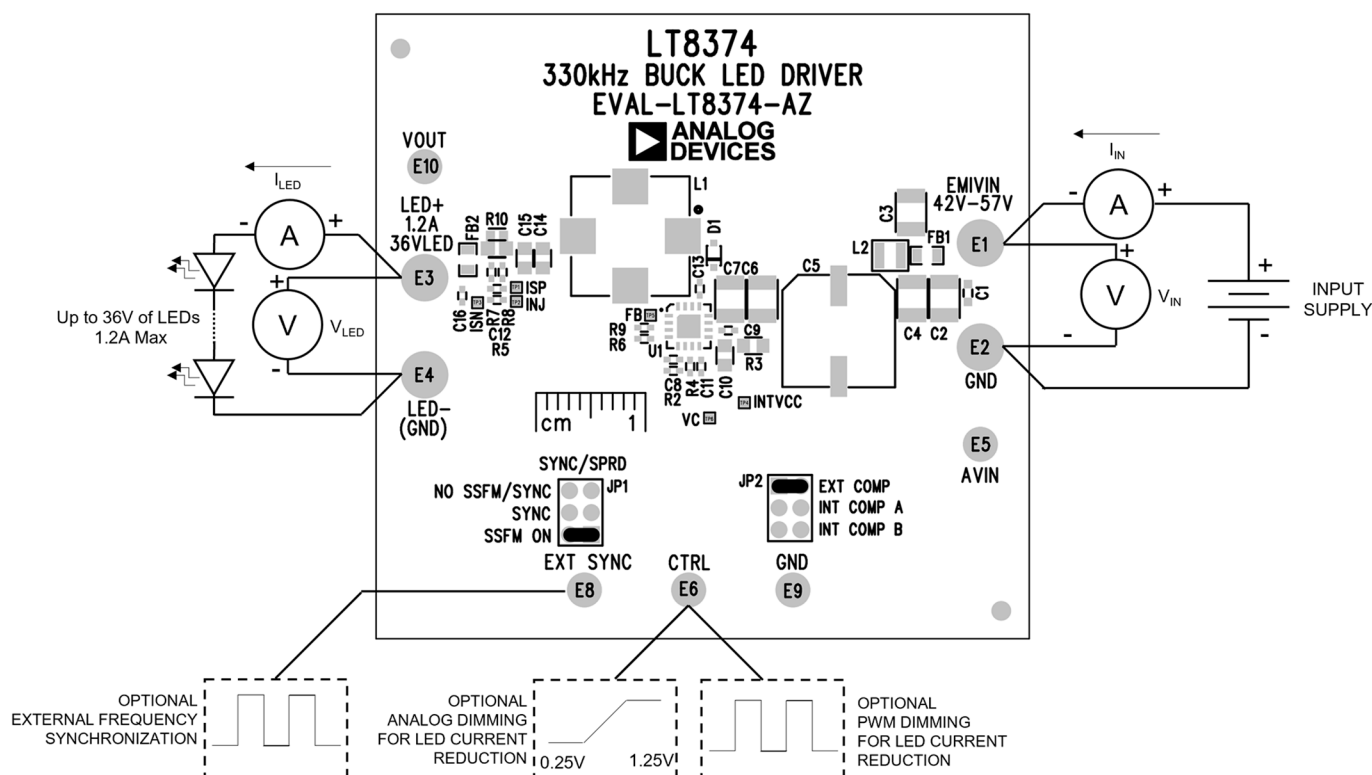


Figure 2. Setup Drawing for EVAL-LT8374-AZ

TEST RESULTS

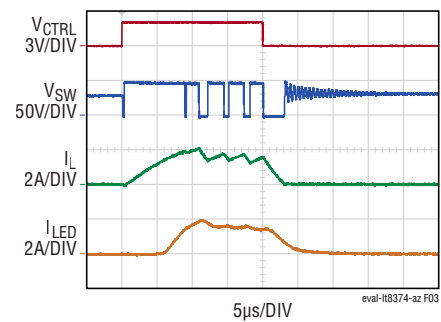


Figure 3. External PWM Dimming with EMI Filters: 48V_{IN}, 36V_{LED}, 1.2A

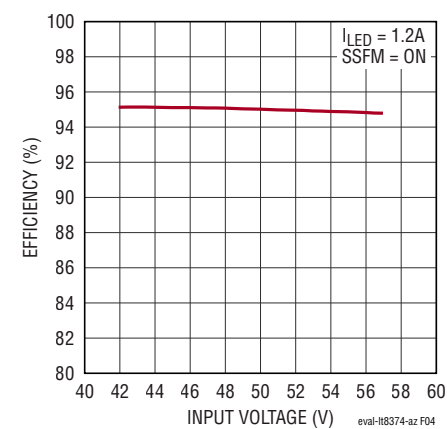


Figure 4. Efficiency vs Input Voltage with EMI Filters Installed and SSFM ON

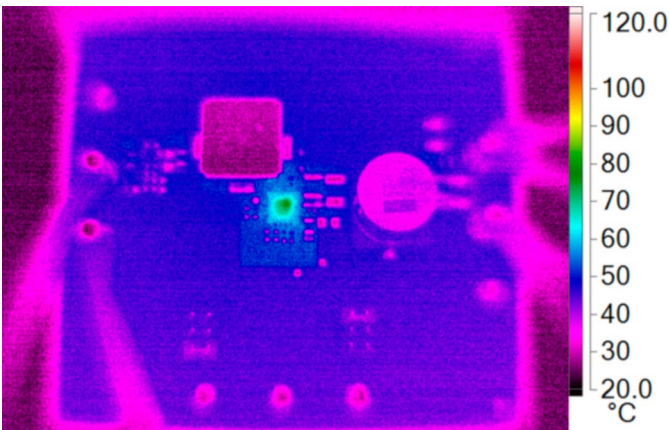
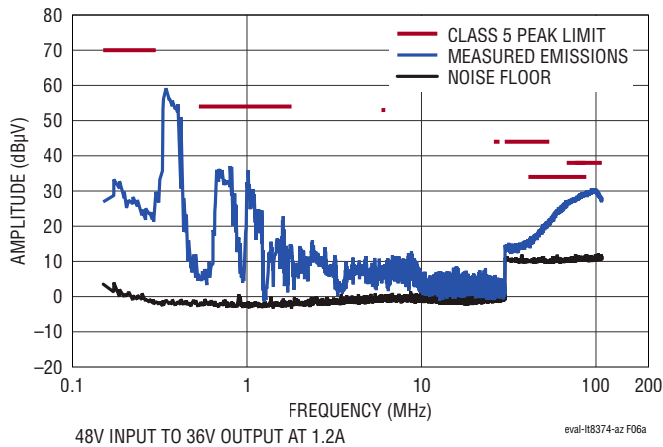
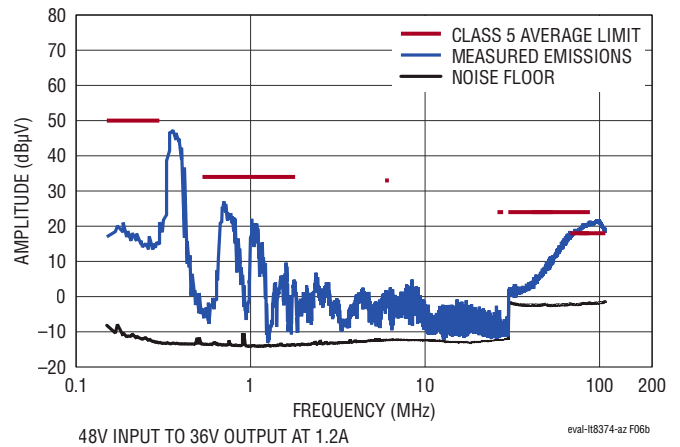


Figure 5. Thermal Image: 48V_{IN}, 36V_{LED}, 1.2A (SSFM ON)

TEST RESULTS

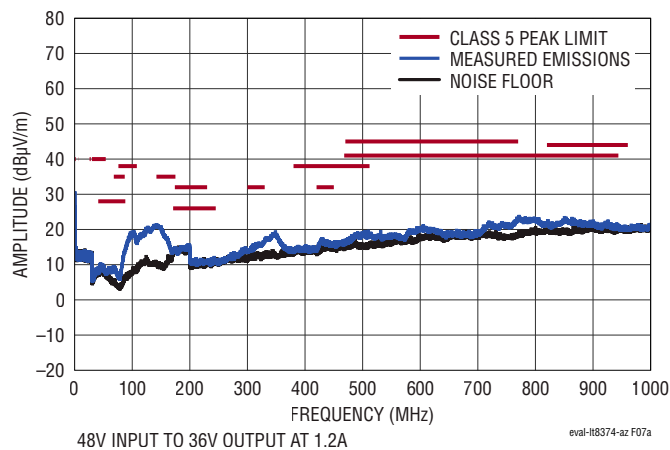


(a) CISPR25 Peak

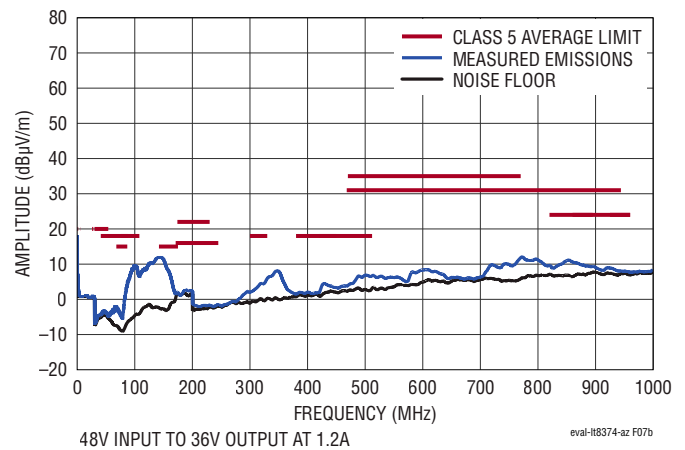


(b) CISPR25 Average

Figure 6. Conducted Emissions (Voltage Method): 48V_{IN}, 36V_{LED}, 1.2A



(a) CISPR25 Peak



(b) CISPR25 Average

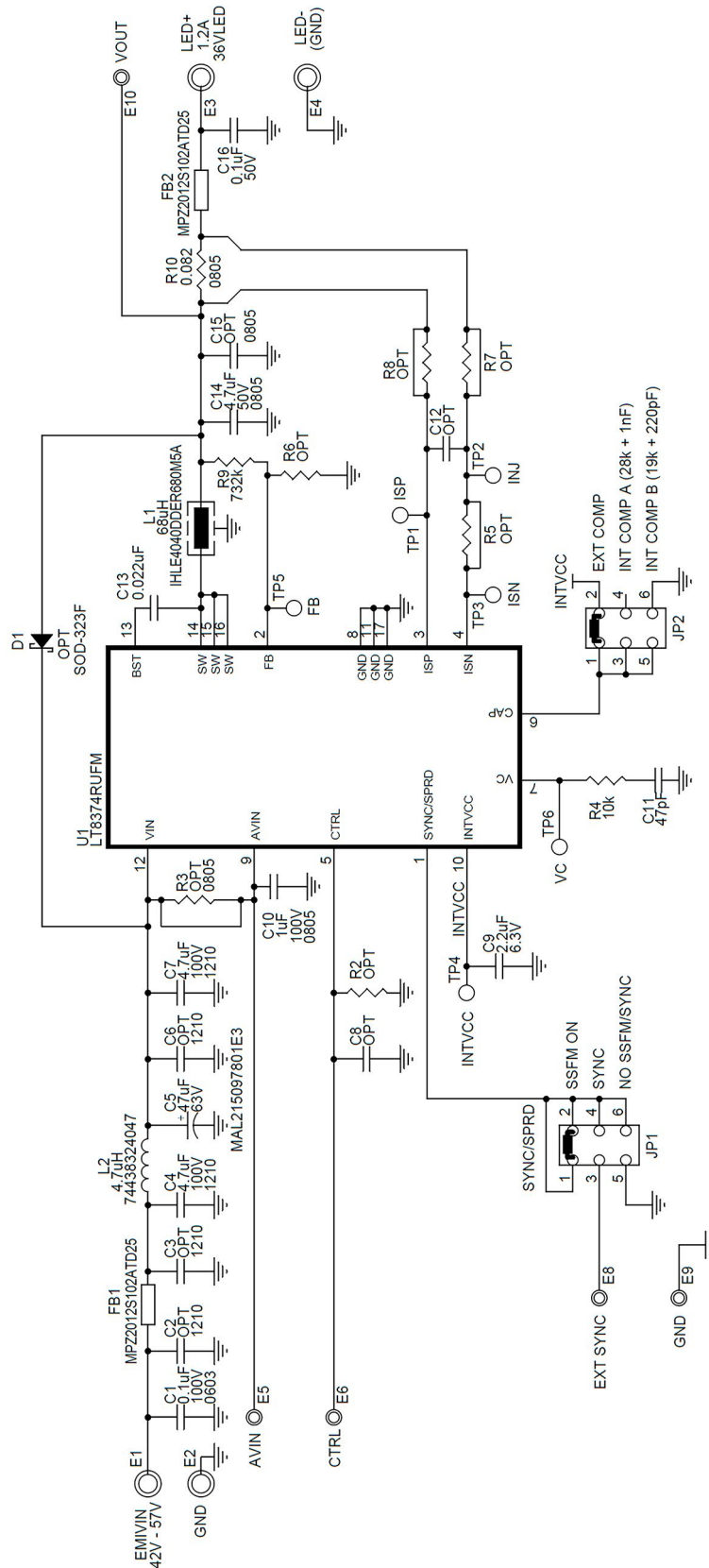
Figure 7. Radiated Emissions (ALSE Method): 48V_{IN}, 36V_{LED}, 1.2A

DEMO MANUAL EVAL-LT8374-AZ

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C7	CAP, 4.7μF, X7S, 100V, 10%, 1210, AEC-Q200	MURATA, GCM32DC72A475KE02L
2	1	C9	CAP, 2.2μF, X5R, 6.3V, 20%, 0402, AEC-Q200	TAIYO YUDEN, JMK105BJ225MVHF
3	1	C10	CAP, 1μF, X7S, 100V, 10%, 0805, AEC-Q200	MURATA, GCM21BC72A105KE36L
4	1	C11	CAP, 47pF, C0G/NP0, 50V, 5%, 0402, AEC-Q200	MURATA, GCM1555C1H470JA16D
5	1	C13	CAP, 0.022μF, X7R, 25V, 10%, 0402, AEC-Q200	MURATA, GCM155R71E223KA55D
6	1	C14	CAP, 4.7μF, X5R, 50V, 10%, 0805, AEC-Q200	TDK, CGA4J3X5R1H475K125AB
7	1	L1	IND., 68μH, PWR, SHIELDED, 20%, 2.4A, 252mΩ, AEC-Q200	VISHAY, IHLE4040DDER680M5A
8	1	R4	RES., 10k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW040210K0FKED
9	1	R9	RES., 732k, 1%, 1/16W, 0402, AEC-Q200	VISHAY, CRCW0402732KFKED
10	1	R10	RES., 0.082Ω, 1%, 1/2W, 0805, AEC-Q200 SHORT SIDE TERM	SUSUMU, KRL1220E-M-R082-F-T5
11	1	U1	IC, LED DRIVER CTRLR, QFN-16	ANALOG DEVICES, INC., LT8374RUFM#WPBF
Optional EMI Filter Components				
12	1	C1	CAP, 0.1μF, X7S, 100V, 10%, 0603, AEC-Q200	TDK, CGA3E3X7S2A104K080AB
13	1	C4	CAP, 4.7μF, X7S, 100V, 10%, 1210, AEC-Q200	MURATA, GCM32DC72A475KE02L
14	1	C5	CAP, 47μF, ALUM ELECT, 63V, 20%, SMD, RADIAL, 1010, AEC-Q200	VISHAY, MAL215097801E3
15	1	C16	CAP, 0.1μF, X7R, 50V, 10%, 0402, AEC-Q200	MURATA, GCM155R71H104KE02D
16	2	FB1, FB2	IND., 1k AT 100MHz, FERRITE BEAD, 25%, 1.5A, 150mΩ, 0805, AEC-Q200	TDK, MPZ2012S102ATD25
17	1	L2	IND., 4.7μH, PWR, SHIELDED, 20%, 1A, 345mΩ	WURTH ELEKTRONIK, 74438324047
Optional Electrical Components				
18	3	C2, C3, C6	CAP, OPTION, 1210	
19	2	C8, C12	CAP, OPTION, 0402	
20	1	C15	CAP, OPTION, 0805	
21	1	D1	DIODE, OPTION, SOD-323F	
22	5	R2, R5, R6, R7, R8	RES., OPTION, 0402	
23	1	R3	RES., OPTION, 0805	
Hardware: For Demo Board Only				
24	4	E1, E2, E3, E4	TEST POINT, TURRET, 0.094" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2501-2-00-80-00-00-07-0
25	5	E5, E6, E8, E9, E10	TEST POINT, TURRET, 0.064" MTG. HOLE, PCB 0.062" THK	MILL-MAX, 2308-2-00-80-00-00-07-0
26	2	JP1, JP2	CONN., HDR, MALE, 2×3, 2mm, VERT, ST, THT	WURTH ELEKTRONIK, 62000621121
27	2	XJP1, XJP2	CONN., SHUNT, FEMALE, 2-POS, 2mm	WURTH ELEKTRONIK, 60800213421

SCHEMATIC DIAGRAM



DEMO MANUAL EVAL-LT8374-AZ



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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