

General Description

This demonstration board utilizes the AL9901 high voltage PWM LED Buck controller with integrated MOSFET providing a cost effective solution for offline high brightness LED applications. This user-friendly evaluation board provides users with quick connection to their different types LEDs string. The demonstration board can be modified to adjust the LED output current (140mA) and the number of series connected LEDs that are driven.

Key Features

- Integrated 650V/2A MOSFET
- High output voltage, 50V
- ~ 86% efficiency
- <5% line regulation (100V_{AC} to 240V_{AC})
- Universal AC input voltage (100V_{AC} to 240V_{AC})
- No electrolytic capacitor
- Low BOM cost

Applications

- A60 Type LED light bulb
- Other LED lighting

AL9901 EV1 Specifications

Parameter	Value
Input Voltage	100 to 240V _{AC}
Output Power	6 – 8W
LED Current	140mA (Adjustable)
LED Voltage	51V
Efficiency	~86%
Number of LEDs	17 LEDs in series (Under Tested)
XYZ Dimension	0.6" x 2.4" x 0.6"
ROHS Compliance	Yes

Evaluation Board



Figure 1: Top View



Figure 2: Bottom View

Connection Instructions

Input Voltage: 100 to 240V_{AC} (AC+, AC-)
 LED Outputs: LED+ (Red), LED- (Black)

Evaluation Board Schematic

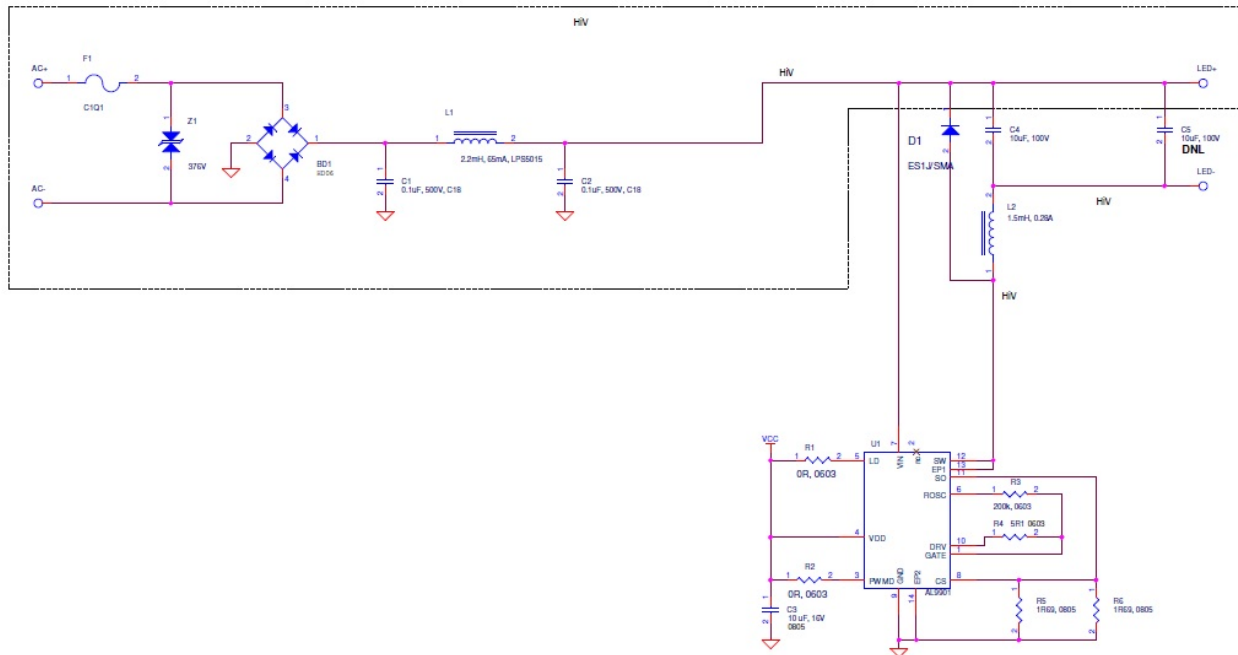


Figure 3: Evaluation Board Schematic

Evaluation Board Layout

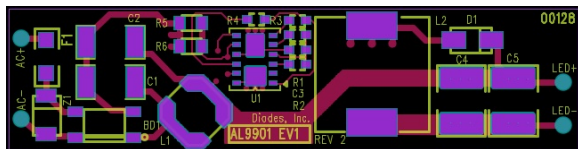


Figure 4: PCB Board Layout Top View

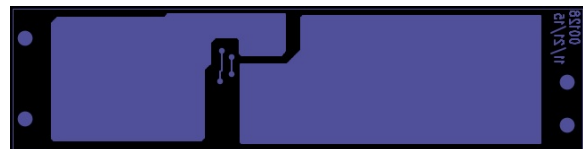


Figure 5: PCB Board Layout Bottom View

Quick Start Guide

1. By default, the evaluation board is preset at 140mA LED Current by R5 and R6. Non-Dimmable by R2, remove R2 to allow PWM Dimming input.
2. Ensure that the AC source is switched OFF or disconnected.
3. Connect the AC line wires of power supply to "AC+ and AC-" on the left side of the board.
4. Connect the anode wire of external LED string to LED+ output test point.
5. Connect the cathode wire of external LED string to LED- output test point.
6. Turn on the main switch. LED string should light up.

Bill of Material

#	Name	QTY	Part number	Manufacturer	Description
1	U1	1	AL9901DFN6040-12	Diodes Inc	LED Driver
2	BD1	1	HD06-T	Diodes Inc	Bridge Rectifiers 0.8A 600V
3	D1	1	ES1G-13-F	Diodes Inc	DIODE Super FAST 1A 400V SMA
4	Z1	1	SMBJP6KE440CA	Diodes Inc	TVS bidirectional diode 600W 602V
5	L1	1	LPS5015-225ML	Coilcraft	2.2mH 64mA
6	L2	1	13R155C	Murata	IND Power 1.5mH
7	C1, C2	2	VJ1812Y104KXEAT5Z	Vishay	CAP CER (MLCC) - SMD/SMT 1812 0.1uF 500V X7R 10%
8	C3	1	C1608X7R1A105K	TDK	CAP CER 1.0uF 10V X7R 0603
9	C5	1	GRM32ER71J106MA12L	Murata	Multilayer Ceramic Capacitors (1210) 10uF 63V X7R 10%
10	R1,R2	2	RC0603JR-070RL	Yageo	JMPR 0.0Ω 1/4W 0603 SMD
11	R3	1	RC0603FR-07200KL	Yageo	RES 200KΩ 1/10W 1% 0603 SMD
12	R4	1	RC0603FR-0722RL	Yageo	RES 22Ω 1/10W 1% 0603 SMD
13	R5, R6	2	RL0805FR-071R69L	Yageo	RES 1.69Ω 1/8W 1% 0805 SMD
14	F1	1	2410SFV1.00FM/125-2	Bel Fuse	Fuse, 1A, 250V, 1810

Functional Performance (No Electrolytic Capacitor across output LEDs)

Board Type	VIN (VAC)	PFC	IIN (mA)	PIN (W)	VLED (V)	ILED (mA)	PLED (W)	ILED Ripple (%)	Efficiency (%)	Athd (%)
AL9901EV1 Module Board	100	0.750	98.63	7.40	48.42	126.7	6.13	100	82.85	61.38
	110	0.730	94.43	7.55	48.52	130.2	6.32	100	83.65	63.22
	120	0.710	90.33	7.71	48.62	133.5	6.49	100	84.22	66.74
	130	0.693	87.12	7.85	48.68	136.3	6.63	100	84.56	71.20
	200	0.615	71.24	8.75	49.05	149.8	7.35	100	83.93	91.73
	210	0.604	70.37	8.90	49.08	151.8	7.45	100	83.73	92.30
	220	0.602	68.28	9.02	49.11	153.3	7.53	100	83.49	99.95
	230	0.592	67.14	9.15	49.12	155.0	7.61	100	83.16	94.22
	240	0.583	66.14	9.30	49.14	156.5	7.69	100	82.73	94.55

Functional Performance (optional 68 μ F Electrolytic Capacitor across output LEDs to reduce ripple)

Board Type	VIN (VAC)	PFC	IIN (mA)	PIN (W)	VLED (V)	ILED (mA)	PLED (W)	ILED Ripple (%)	Efficiency (%)	Athd (%)
AL9901EV1 Module Board	100	0.759	100.41	7.63	48.82	131.4	6.41	50	84.09	59.02
	110	0.740	95.21	7.74	48.85	135.1	6.60	50	85.26	59.71
	120	0.723	90.93	7.88	48.88	138.5	6.77	50	85.95	65.55
	130	0.706	87.30	8.01	48.91	141.5	6.92	50	86.42	68.75
	200	0.629	71.07	8.85	49.09	156.3	7.67	50	86.68	93.69
	210	0.616	69.56	8.99	49.11	158.3	7.77	50	86.43	98.13
	220	0.609	68.26	9.13	49.10	160.2	7.86	50	86.18	95.41
	230	0.607	66.36	9.24	49.11	161.7	7.94	50	85.93	94.56
	240	0.601	65.63	9.38	49.12	163.4	8.03	50	85.55	98.23

Functional Performance

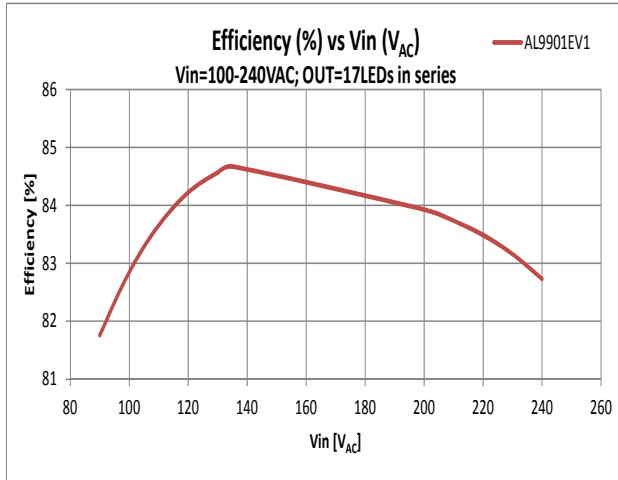


Figure 1. Efficiency vs. Vin

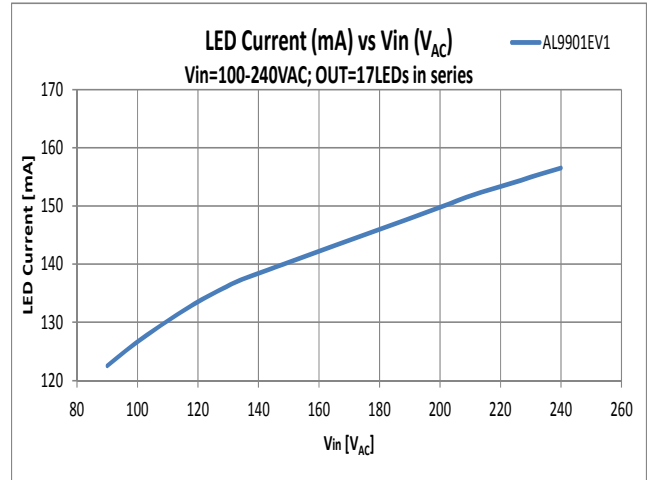


Figure 2. LED Current vs. Vin

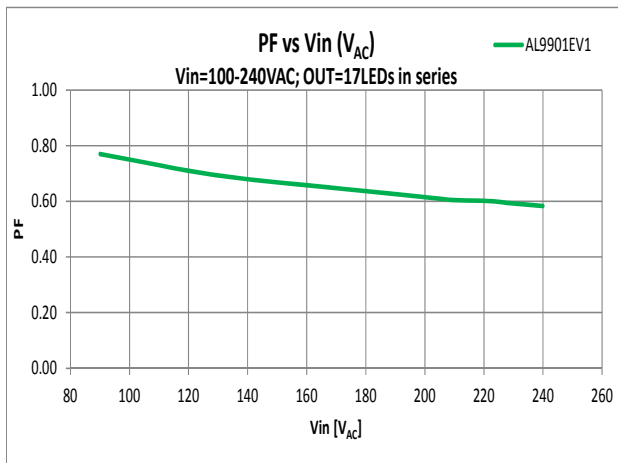
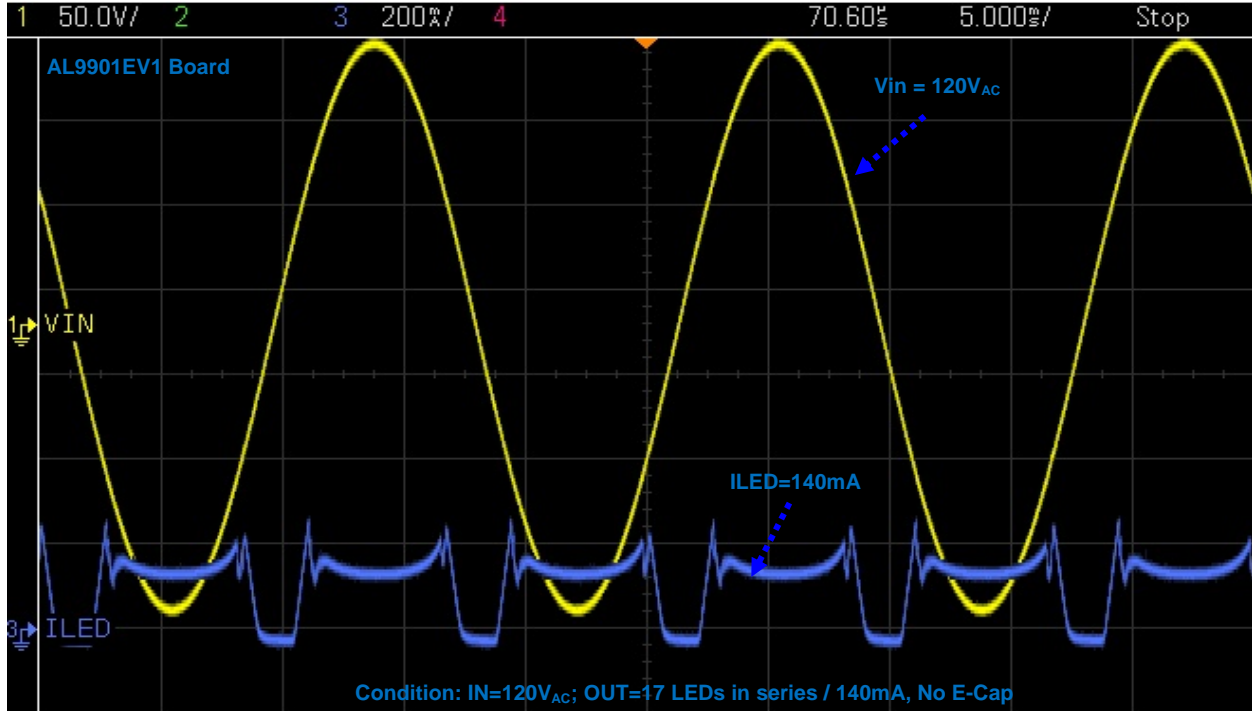
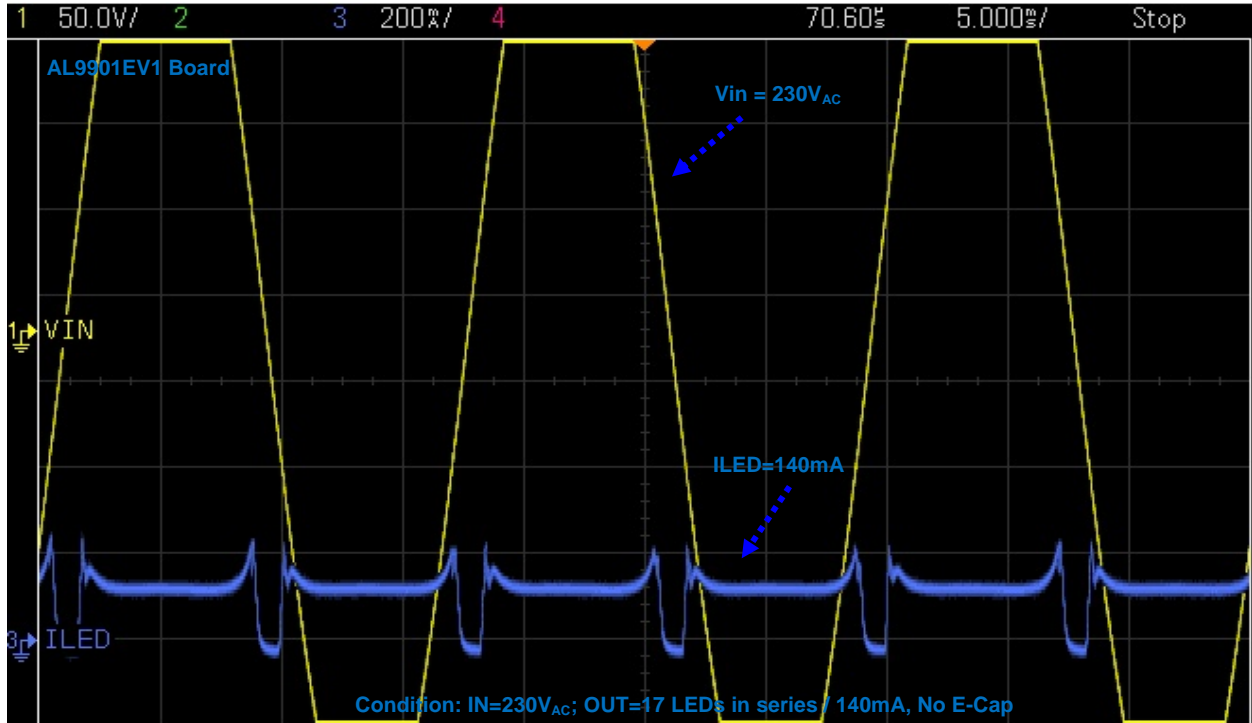


Figure 3. PFC vs. Vin

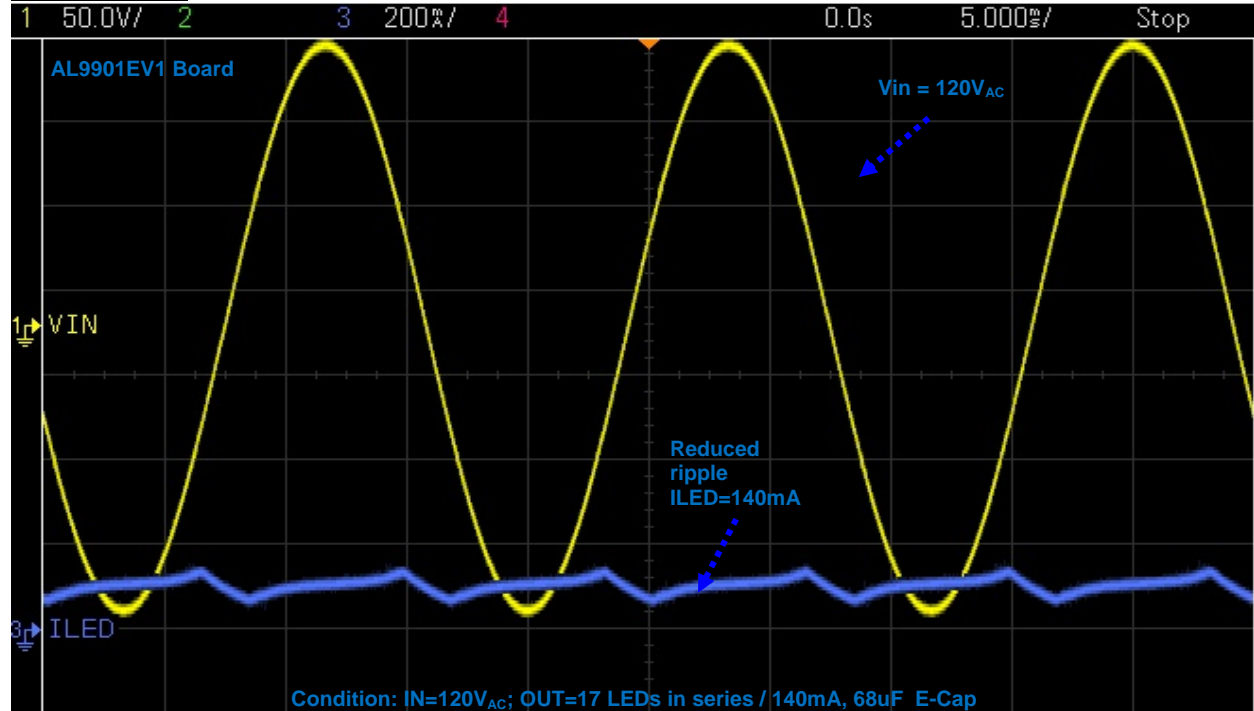
Waveform #1=> Channel 1: Vin = 120V_{AC}, Channel 3: ILED



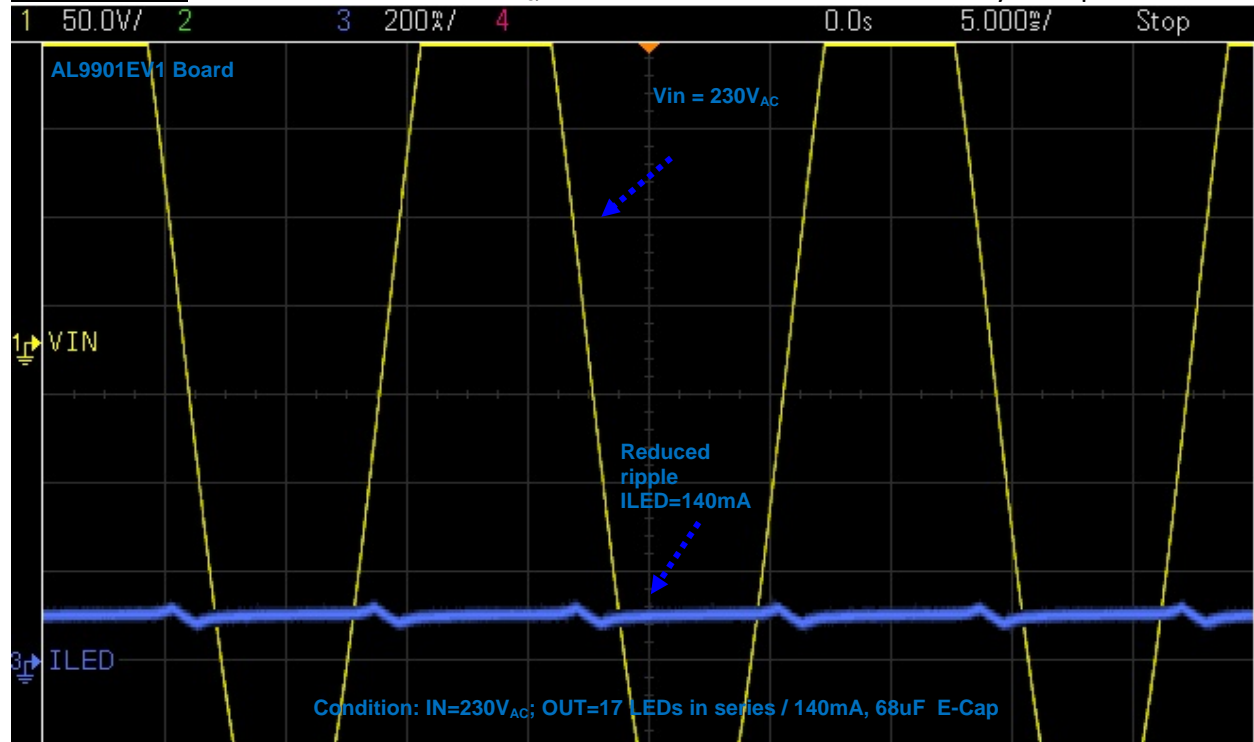
Waveform #2=> Channel 1: Vin = 230V_{AC}, Channel 3: ILED



Waveform #3=> Channel 1: Vin = 120V_{AC}, Channel 3: ILED with 68uF Electrolytic Capacitor



Waveform #4=> Channel 1: Vin = 230V_{AC}, Channel 3: ILED with 68uF Electrolytic Capacitor



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