AL17050EV1 User Guide
High Voltage Step Down Converter

General Description

This demonstration board utilizes AL17050 to build a cost effective solution for high voltage Buck converter applications.

AL17050 integrates a 500V MOSFET and can works with a single winding inductor and very few external components to provide accurate constant voltage output and good dynamic performance.

This user guide contains rich information for the users. A bill of materials is included that describes the parts used on this board. A schematic and PCB layout is also included along with measured system performance characteristics and test waveforms. These materials can be used as a reference design for your products to improve your product's time to market.

Key Features

1. Universal 85 to 265 VAC Input Range
2. Constant Voltage (CV) Control
3. Internal MOSFET up to 500V
4. Low Operation Current: 100μA (Static)
5. Under Voltage Lock Out (UVLO)
6. Output Short Protection
7. Over Load Protection
8. Over Temperature Protection (OTP)

Applications

- Home Appliance Applications
- IoT Applications
- Industrial Controls
- Standby Power

Specifications

Parameter	Value
AC Input Voltage	85Vac ~ 265Vac
Output Power	0.2W
Output Current	60mA
Output Voltage	3.3V
Efficiency	>52 %
Dimension	32mm*15mm
RoHS Compliance	Yes

Evaluation Board

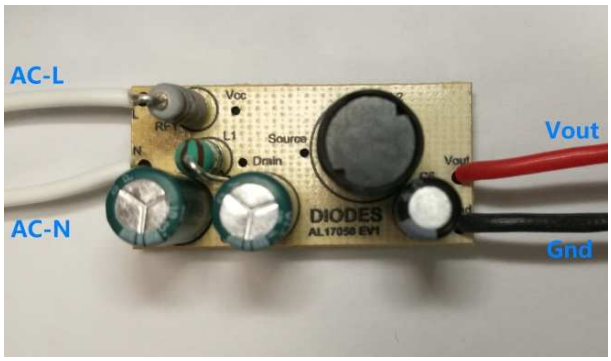

Figure 1: Top View

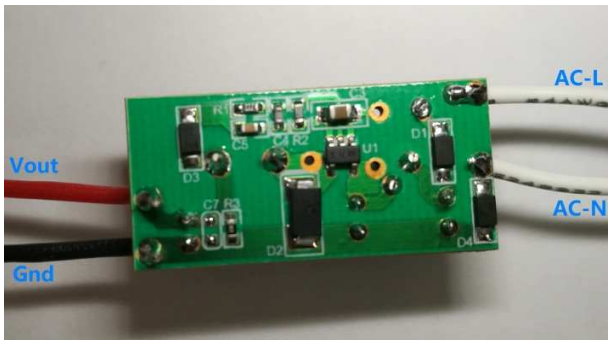

Figure 2: Bottom View

Connection Instructions:
AC Line Input: White L line
AC Neutral Input: White N line
Positive Output: Vout (Red)
Negative Output: Gnd (Black)

Board Layout

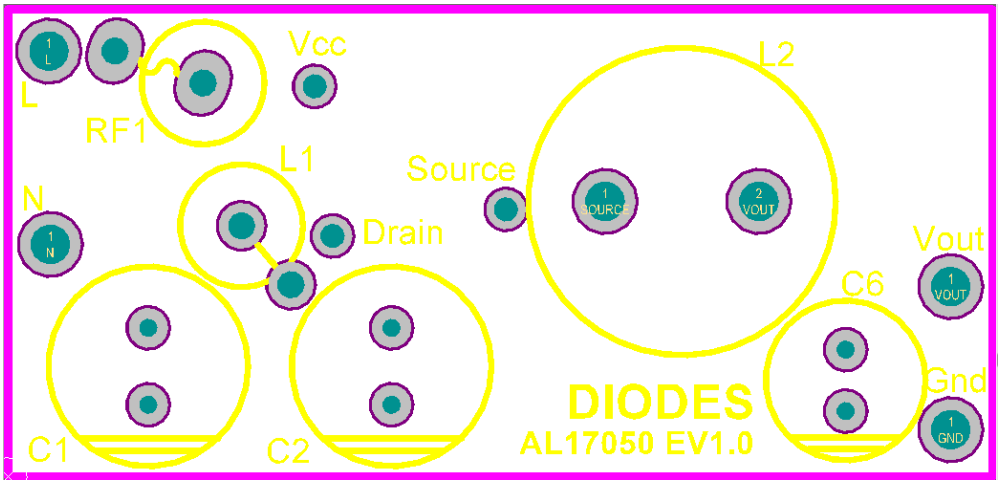

Figure 3: PCB Layout Top View

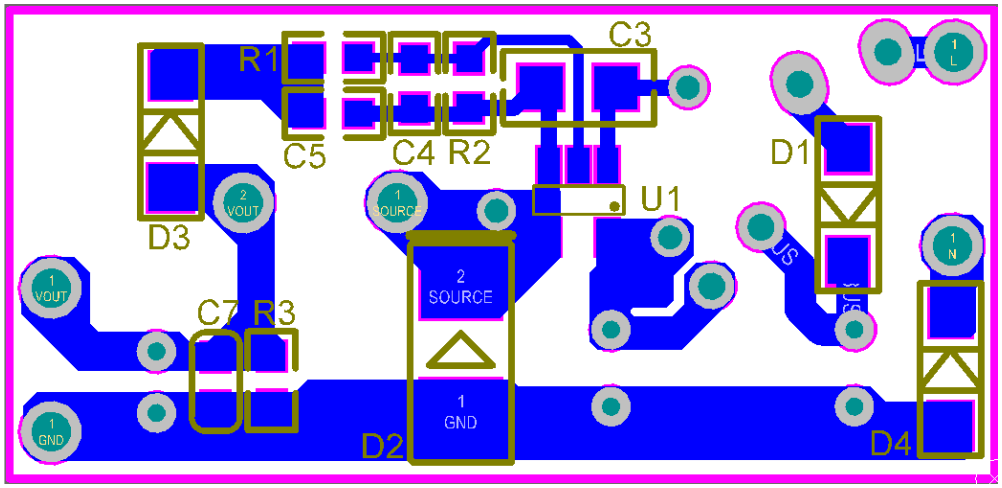

Figure 4: PCB Layout Bottom View

Quick Start Guide

1. Ensure that the AC source is switched OFF or disconnected.
2. Connect the AC line wires of power supply to “L” and “N” wires on the left side of the board.
3. Connect the red terminal of the electronic load to the “Vout” wire.
4. Connect the black terminal of the electronic load to the “Gnd” wire.
5. Turn on the main switch. The electronic load should show a 3.3V output.

Schematic

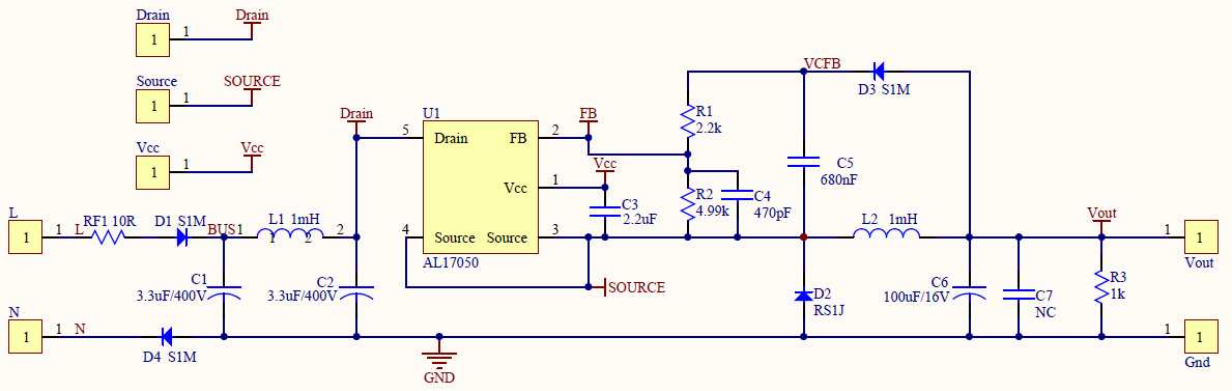

Figure 5: Schematic Circuit

Bill of Material

Item	Quantity	Package	Description
RF1	1	DIP	10Ω, Fuse Resistor, 5%, 1W
D1,D3,D4	3	SOD123	S1MSWFQ, Diode,1000V,1A, Diodes Inc
D2	1	D-Flat	RS1J, Diode,600V,1A,trr=250ns, Diodes Inc
C1,C2	2	DIP	3.3uF, Electrolytic Capacitor,400V,6.3*9, AISHI
C3	1	0805	2.2uF, Ceramic Capacitor,25V,X5R,20%
C4	1	0603	470pF, Ceramic Capacitor,50V,X7R,5%
C5	1	0603	680nF, Ceramic Capacitor,16V,X7R,10%
C6	1	DIP	100uF, Electrolytic Capacitor,16V,5*11
L1	1	DIP	1mH, Inductor, Color-ring
L2	1	DIP	1mH, Inductor, Choke, 8*10
R1	1	0603	2.2kΩ, SMD Film Resistor, 1%
R2	1	0603	4.99kΩ, SMD Film Resistor, 1%
R3	1	0603	1kΩ, SMD Film Resistor, 1%
U1	1	SOT25	AL17050, IC, Diodes Inc

System Performance

The AL17050 evaluation board has excellent system performance. With very low BOM cost, the system can achieve high efficiency, low load regulation rate, low ripple and good load transient performance.

System efficiency

Figure 6 shows the measured efficiency versus load. The system efficiency at 60mA current load could reach 58% with 120Vac input and 54% with 230Vac input.

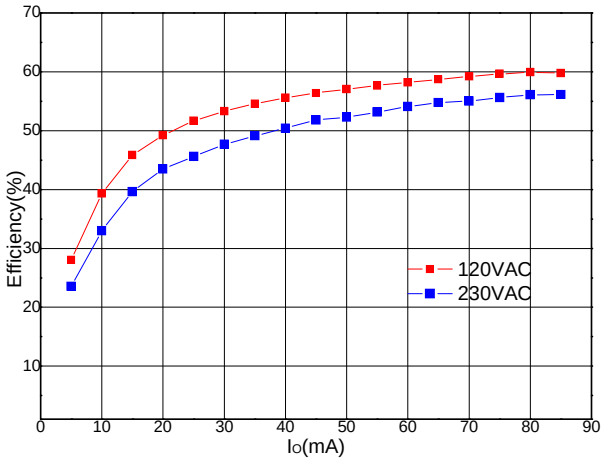

Figure 6: Efficiency vs load current

Load Regulation

The measured output voltage versus load is shown in Figure 7. The output voltage ranges from 3.45V to 3.3V, indicating the load regulation rate lower than 5%.

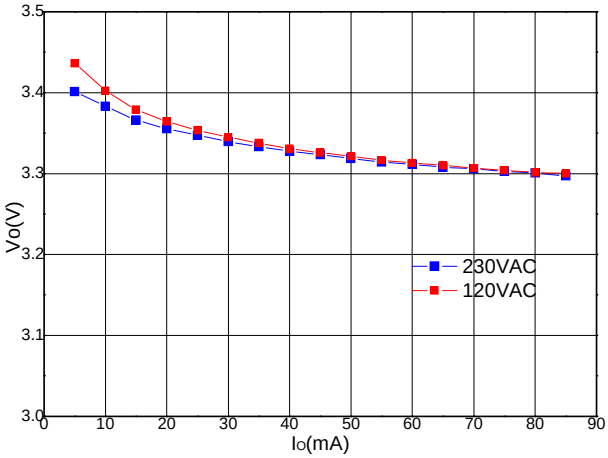

Figure 7: Output voltage vs load current

Output Ripple

The output voltage ripple is measured at 60mA load at both 120Vac and 230Vac input. In Figure 8, channel 1 (Yellow color) shows the waveform of Vout.

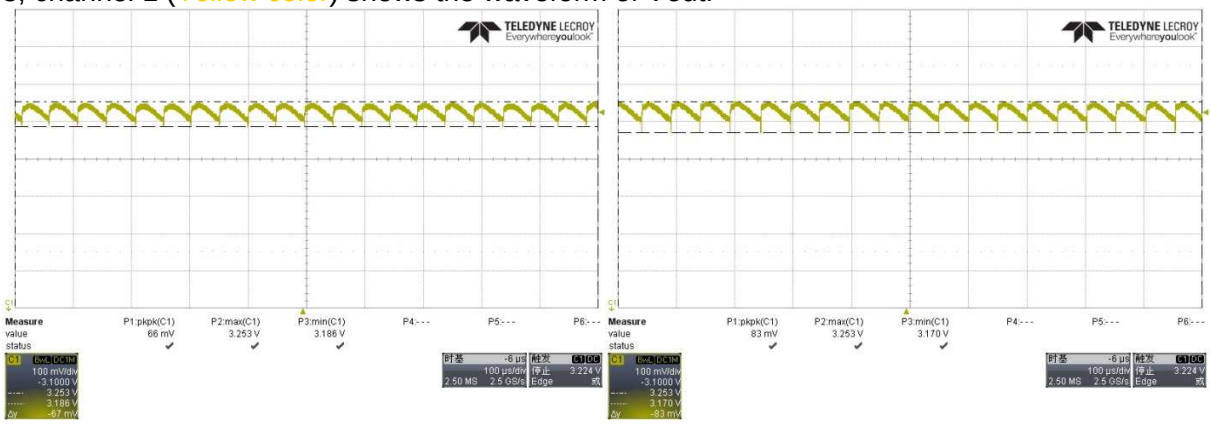

Figure 8: Output voltage ripple with 120Vac (Left) and 230Vac (Right)

The output voltage ripple peak to peak value is 66mV for 120Vac input and 83mV for 230Vac.

Load Transient Response

The load transient response is tested with the load repeatedly switching from 0mA to 60mA in 15Hz frequency. The load switching slew rate is 1A/us. In Figure 9, channel 2 (Red color) shows the waveform of Vout and channel 4 (Green color) shows Iout.

Figure 9: Load transient waveform with 120Vac (Left) and 230Vac (Right)

With 120Vac input, the overshoot and undershoot caused by the load transient is respectively 13mV and 51mV. With 230Vac input, the maximum overshoot and undershoot caused by the load transition are 43mV and 150mV, respectively. Thus, the minimum output voltage in worst case is 3.15V.

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