AL8861QEV1
EVB User Guide

General Description

The AL8861Q is a hysteresis mode DC-DC step-down converter, designed for driving single or multiple series connected LEDs efficiently from a voltage source higher than the LED voltage. The device can operate with an input supply voltage from 4.5V to 40V and provide an externally adjustable output current up to 1.5A for MSOP-8EP package. Depending upon supply voltage and external components, this converter can provide up to 40 watts output power.

The AL8861Q integrates the power switch and a high-side output current sensing circuit, which uses an external resistor to set the nominal average output current.

Dimming can be realized by applying an external control signal to the VSET Pin. The VSET Pin will accept either a DC voltage signal or a PWM signal.

The soft-start time can be adjusted by an external capacitor from the VSET Pin to Ground. Applying a voltage of 0.2V or lower to the VSET Pin can turn off the output and make the device enter into standby state with low power consumption.

The AL8861Q has been qualified to AEC-Q100 Grade 1 and is Automotive Grade supporting PPAPs.

Applications

- Automotive Interior LED Lamps
- Automotive Exterior LED Lamps

Key Features

- AEC-Q100 Grade 1 Qualified
- Wide Input Voltage Range: 4.5V to 40V
- Output Current Up to 1.5A
- Internal 40V NDMOS Switch
- Typical 5% Output Current Accuracy
- Single Pin for On/Off and Brightness Control by DC Voltage or
- PWM Signal
- High Efficiency (>95%)
- LED Short-Circuit Protection
- Inherent LED Open-Circuit Protection
- Over Temperature Shutdown
- Up to 1MHz Switching Frequency
- Pb-Free MSOP-8EP Packages
- Totally Lead-Free & Fully RoHS Compliant
- Halogen and Antimony Free. “Green” Device

AL8861QEV1 Specifications

Parameter	Value
Input Voltage	4.5VDC to 40VDC
LED Current	1.5A
Number of LEDs	1~10 LEDs
XYZ Dimension	63mm x 40mm x 10mm

Evaluation Board

Figure 1: Top View

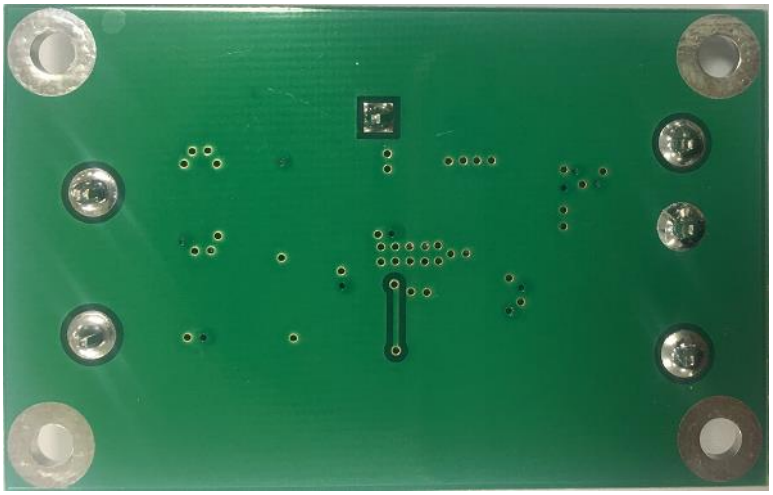


Figure 2: Bottom View

Connection Instructions

Power Supply Input: 4.5~40VDC (VIN, GND)
VSET: Internal voltage ref. pin (2.5V). This pin can be used to achieve dimming and for switching the output current off. Leave floating for normal operation.
PWM Signal Input: Remove C3, apply PWM signal to VSET (VSET, GND)
Analog Signal Input: Connect 100nF capacitor to C3, apply analog signal to VSET (VSET, GND)
LED A: LED A connects to the external LED anode
LED K: LED K connects to the external LED cathode

Evaluation Board Schematic

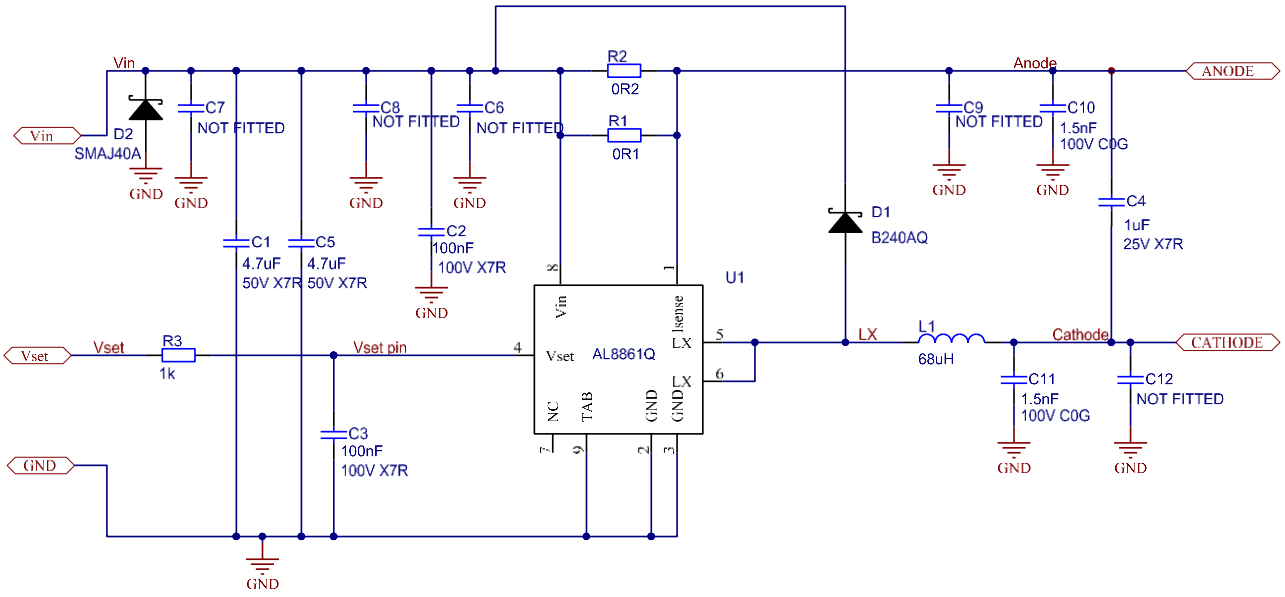


Figure 3: Evaluation Board Schematic

Evaluation Board Layout

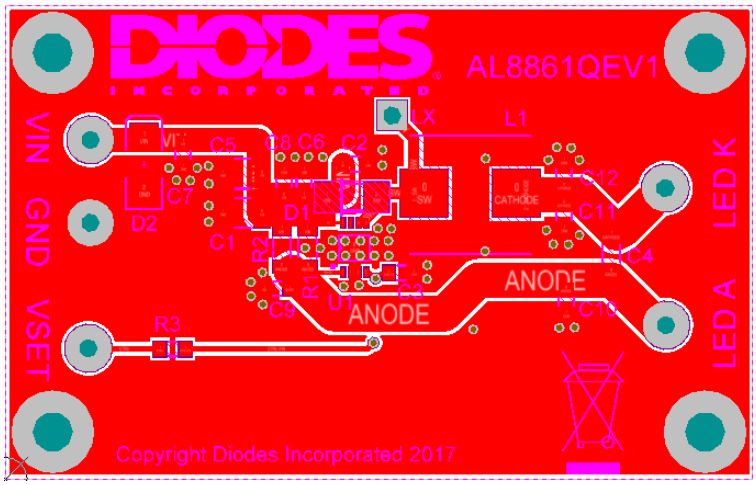


Figure 4: PCB Board Layout Top View

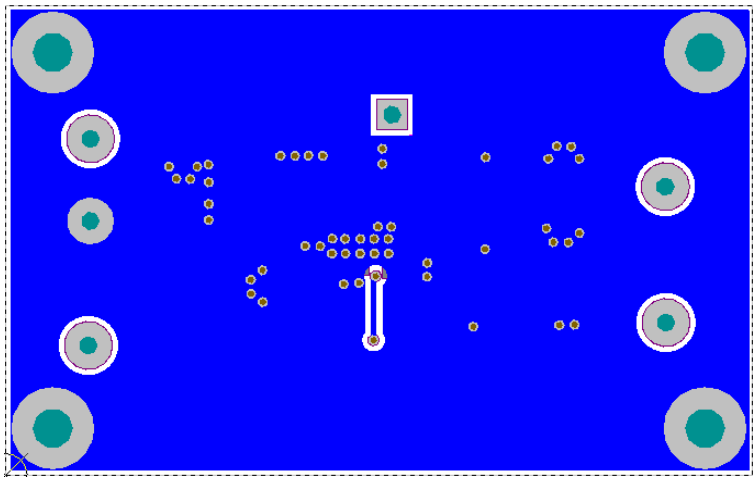


Figure 5: PCB Board Layout Bottom View

Quick Start Guide

1. By default, the evaluation board is preset at 1.5A LED Current by R1 and R2.
2. Non-dimming operation: Leave VSET pin floating for normal operation.
3. Power Supply: Connect the 5~40VDC to VIN & GND pin to supply the system and AL8861Q.
4. PWM Dimming: Remove C4; apply a PWM signal (low level < 0.3V and high level > 2.5) to VSET pin to dim the LEDs. The recommended PWM signal frequency is from 100Hz to 1kHz, and the PWM duty is from 1% to 100%.
5. Analog Dimming: Connect 100nF capacitor to C3; the VSET pin may be driven between 0.3V and 2.5V adjusting the output current from 5% to 100% of I_{LED}.

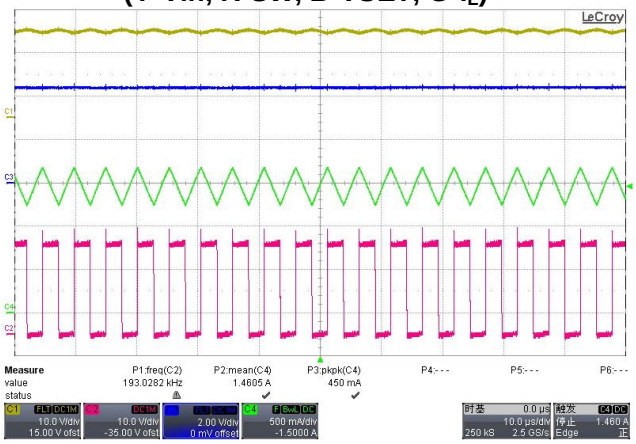
Bill of Material

Ref	Value	Package	Part Number	Manufacturer	Notes
U1	AL8861Q	MSOP-8EP	AL8861QSP-13	Diodes	DC-DC converter
D1	40V, 2A	SMA	B240AQ-13-F	Diodes	Schottky diode
D2	40V	SMA	SMAJ40A	Diodes	TVS diode
R1	0R100	1206		Generic	+/-1%
R2	0R200	1206		Generic	+/-1%
R3	1K	0805		Generic	+/-5%
C1, C5	4.7µF, 50V	1210	C1210X475K5RAC	Generic KEMET	X7R
C2, C3	100nF,100V	0805	NMC0805X7R104K100	Generic NIC Comps	X7R
C4	1µF, 50V	1206	NMC1206X7R105K100	Generic NIC Comps	X7R
C10, C11	1.5nF, 100V	0805		Generic	C0G
C6,C7, C8,C9, C12	Not Fitted	0805			X7R Optional capacitor
L1	68µH	1280	7447714680	Würth Elektronik	68µH, ~0.1R, ~1.9A

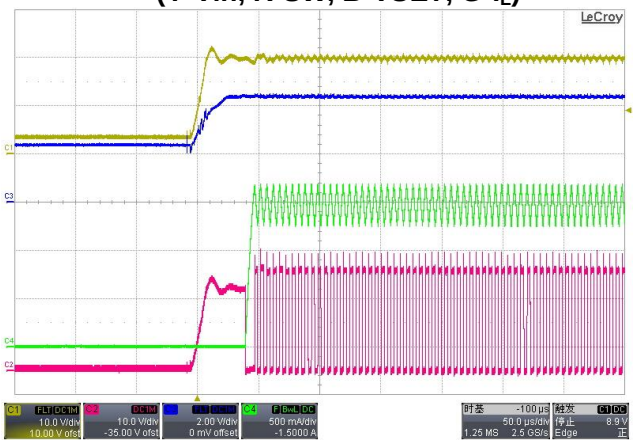
Note: The component part numbers are correct at the time of publication. Diodes Inc reserves the right to substitute other parts where necessary, without further notification.

Functional Waveforms

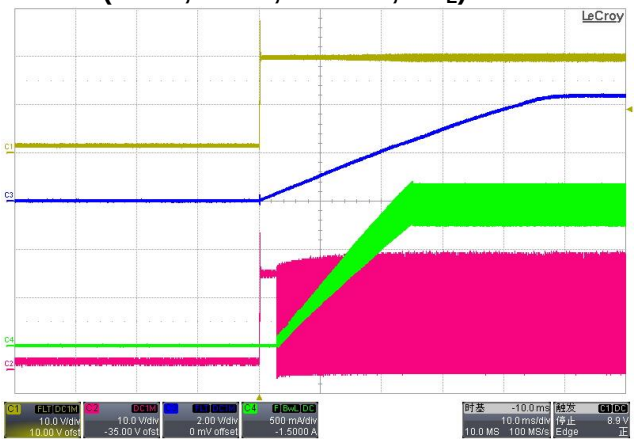
Switching waveform(Vin=20V, 3LEDs)
(Y-Vin, R-SW, B-VSET, G-I_L)



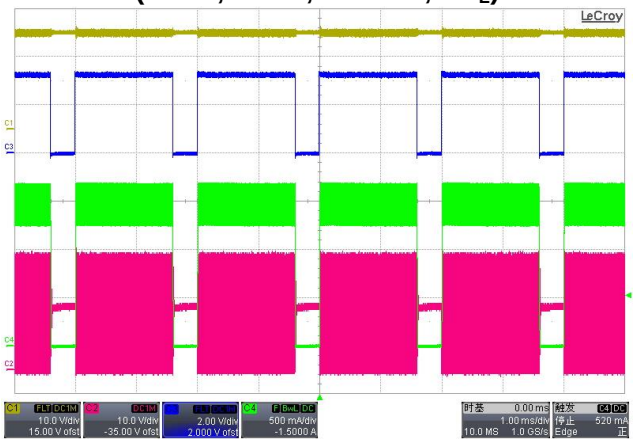
Start-up waveform(Vin=20V, 3LEDs)
(Y-Vin, R-SW, B-VSET, G-I_L)



Soft Start waveform
(Vin=20V, 3LEDs, C4=10nF)
(Y-Vin, R-SW, B-VSET, G-I_L)

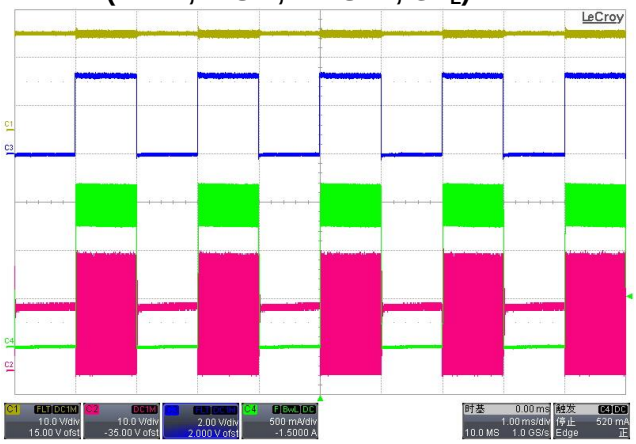


PWM Dimming waveform(Vin=20V, 3LEDs)
(PWM frequency=500Hz, Duty=80%)
(Y-Vin, R-SW, B-VSET, G-I_L)

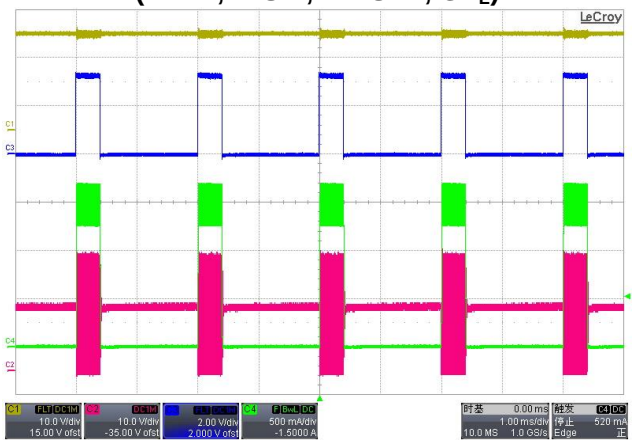


Functional Waveforms

PWM Dimming waveform(Vin=20V, 3LEDs)
(PWM frequency=500Hz, Duty=50%)
(Y-Vin, R-SW, B-VSET, G-I_L)

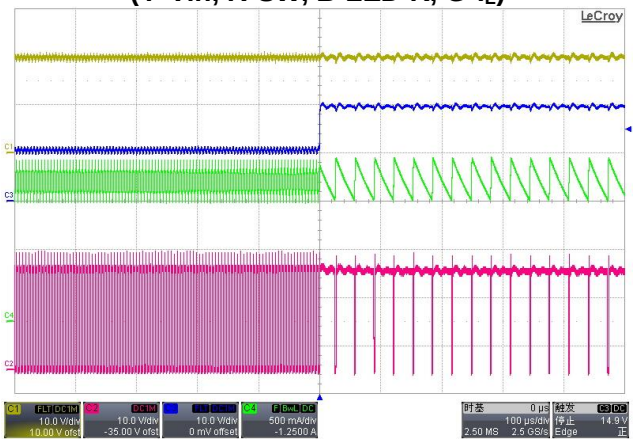


PWM Dimming waveform(Vin=20V, 3LEDs)
(PWM frequency=500Hz, Duty=20%)
(Y-Vin, R-SW, B-VSET, G-I_L)



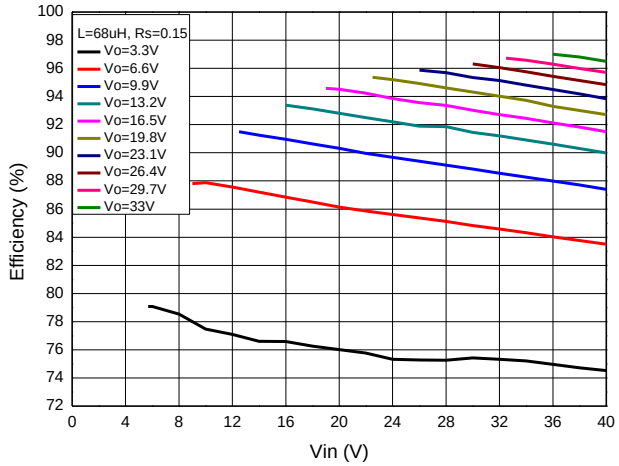
LED open protection(Vin=20V, 3LEDs)
(Y-Vin, R-SW, B-VSET, G-I_L)

LED short protection(Vin=20V, 3LEDs)
(Y-Vin, R-SW, B-LED K, G-I_L)

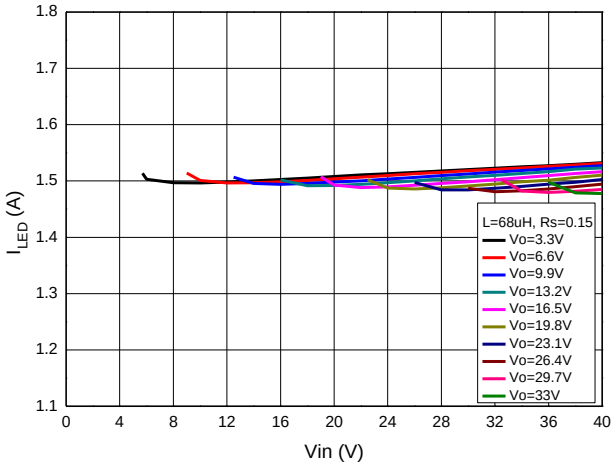


Functional Data Curves

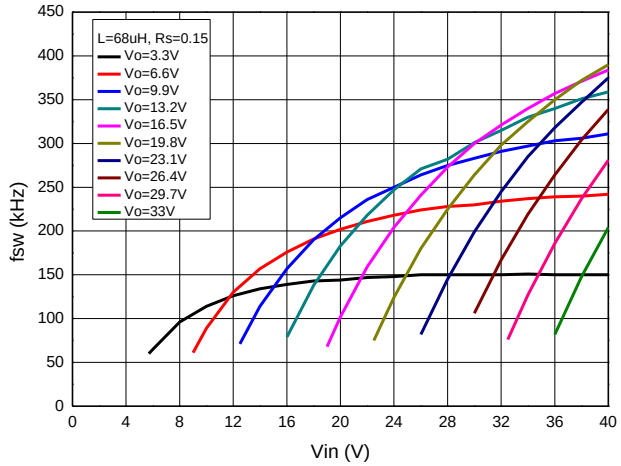
Efficiency vs. Input Voltage



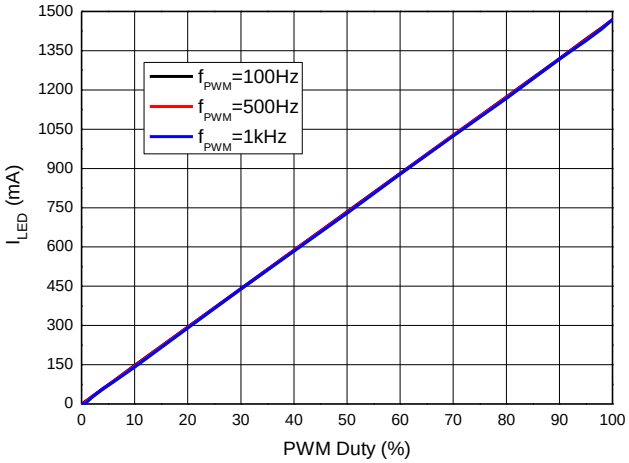
LED Current vs. Input Voltage



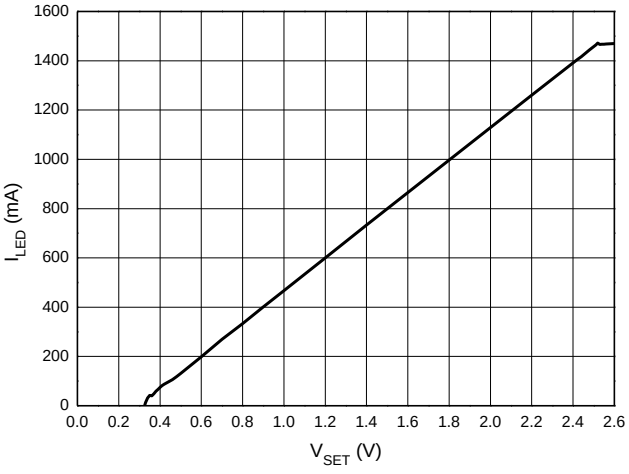
Operating Frequency vs. Input Voltage



PWM Dimming (Vin=20V, 3LEDs)



Analog Dimming (Vin=20V, 3LEDs)



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