

### General Description

The DIODES AL8862Q is a step-down DC-DC converter designed to drive LEDs with a constant current. The AL8862Q operates with an input supply voltage from 5V to 55V and provides an externally adjustable output current up to 1A. Series connection of the LEDs provides identical LED currents resulting in uniform brightness and eliminating the need for ballast resistors. The AL8862Q switches at frequencies up to 1MHz. This allows for the use of smaller size external components, hence minimizing the PCB size.

The AL8862Q integrates the power switch and a high-side output current sensing circuit. The maximum output current of AL8862Q is set via an external resistor connected between the VIN and SET input pins. Dimming is achieved by applying either a DC voltage or a PWM signal at the CTRL input pin. The soft-start time can be adjusted using an external capacitor from the CTRL pin to the ground. An input voltage of 0.3V or lower at CTRL pin will shut down the power switch.

The AL8862Q is qualified to AEC-Q100 Grade 1 and is automotive grade to support PPAPs.

### Applications

- Automotive interior LED lamps
- Automotive exterior LED lamps

### Key Features

- 2.0V to 60V Wide Input Voltage Range
- Wide Input Voltage Range: 5V to 55V
- Output Current up to 1A
- Internal 55V NDMOS Switch
- Typical 4% Output Current Accuracy
- Single Pin for On/Off and Brightness Control by DC Voltage or
- PWM Signal
- High Efficiency (Up to 97%)
- Fault Status Indication for Abnormal Operation
- LED Short-Circuit Protection
- Inherent Open-Circuit LED Protection
- Current-Sense Resistor Short-Circuit Protection
- Overtemperature Shutdown
- Up to 1MHz Switching Frequency
- SO-8EP Package Available in Green Molding Compound (No Br, Sb)

### AL8862QEV2 Specifications

Parameter	Value
Input Voltage	9VDC to 16VDC
LED Current	1A
Number of LEDs	1~3 pcs
XY Dimension	68mm x 46mm

### EVB Physical Picture

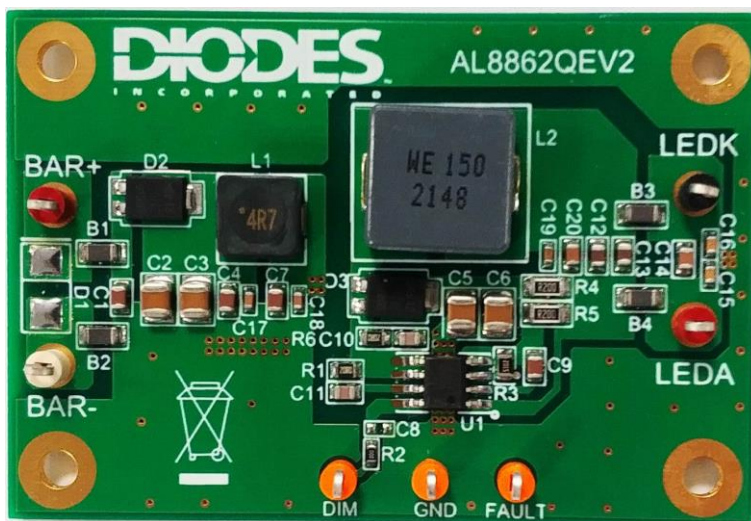


Figure 1. Top View

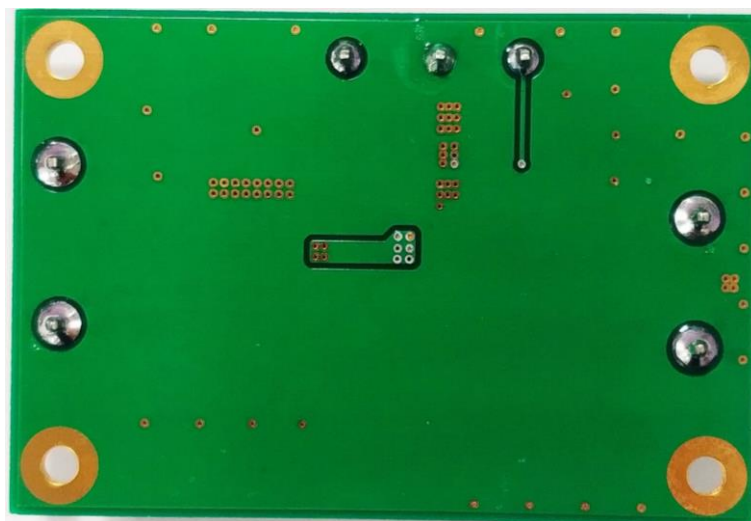
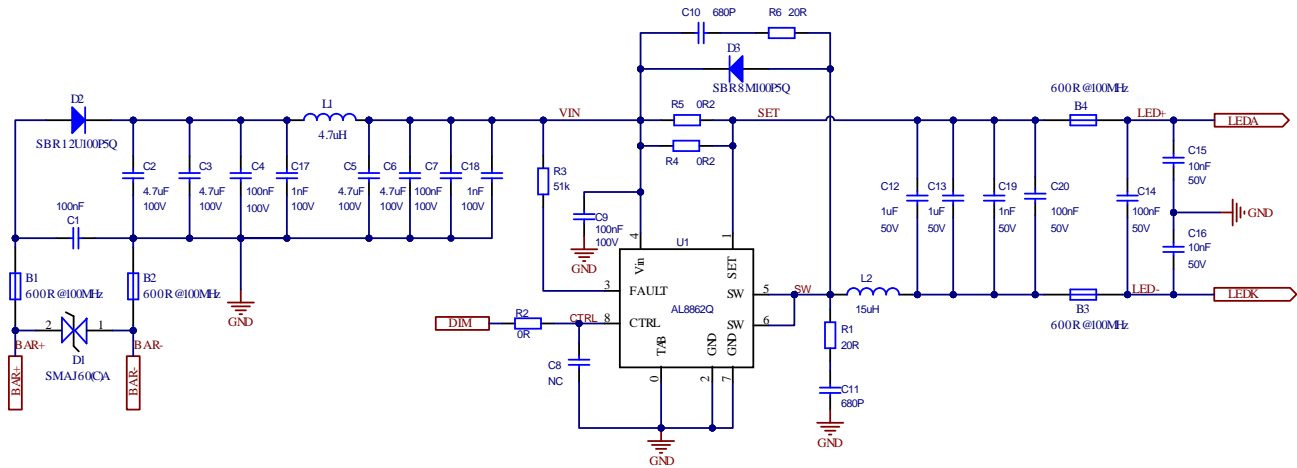


Figure 2. Bottom View

### Connection Instructions and Quick Start Guide

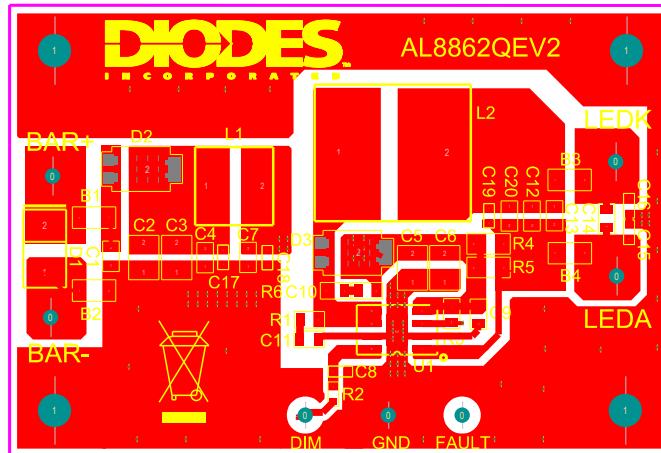
1. Connect LED string anode end to “LEDA” and connect LED string cathode end to “LEDK”.
2. Power Supply Input: 4.5~16VDC, connect two DC line wires to the BAR+ and BAR-terminals on the evaluation board. It’s better to set at least 3V voltage gap between input and output.
3. For PWM dimming operation: supply a 0-3.3V 200Hz~2 kHz signal between DIM & GND.
4. The LED current of demonstration board is preset at 1A.
5. Ensure that the DC source is switched OFF or disconnected before soldering or connecting.
6. Ensure that the area around the board is clear and safe, and preferably that the board and LEDs are enclosed in a transparent safety cover.
7. Turn on the main switch. LED string should light up.

**Evaluation Board Schematic**

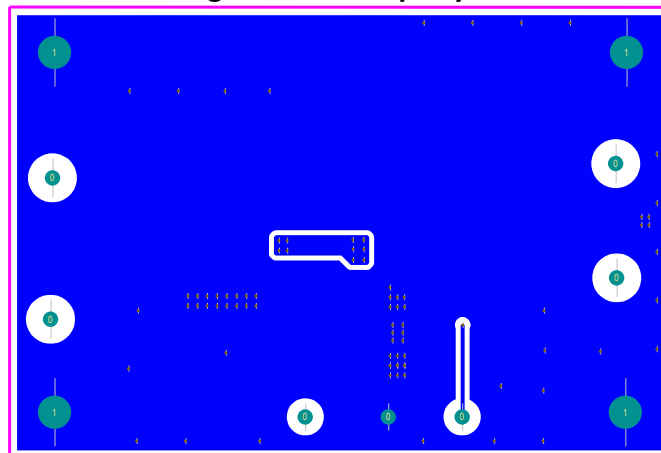


**Figure 3. Evaluation Board Schematic**

**Evaluation Board Layout**



**Figure 4. PCB Top Layer**

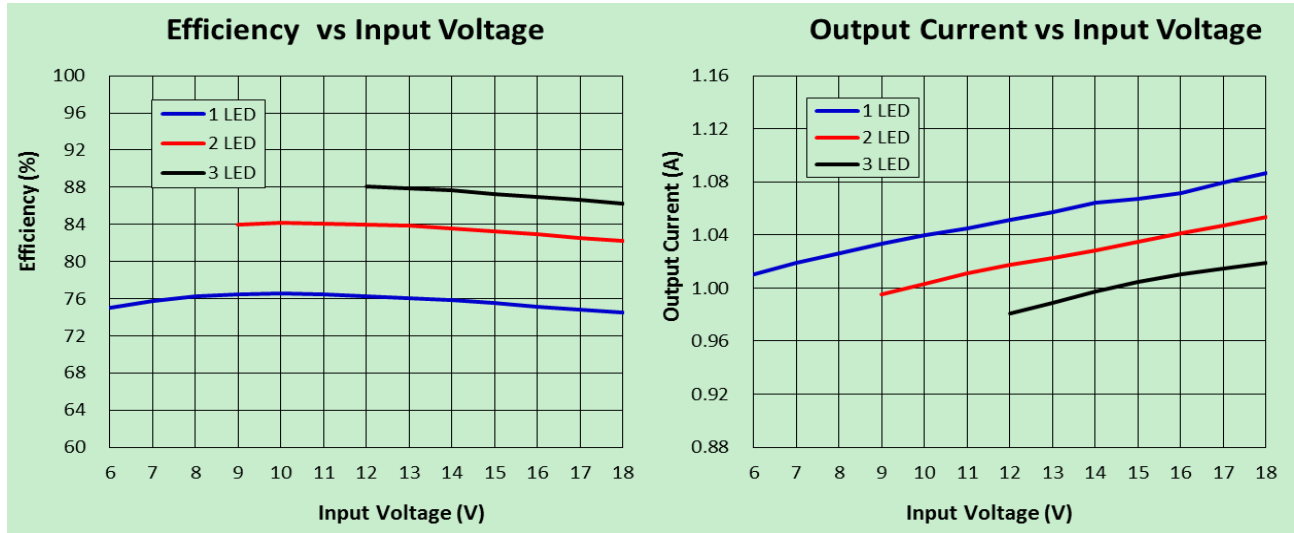


**Figure 5. PCB Bottom Layer**

### Bill of Material

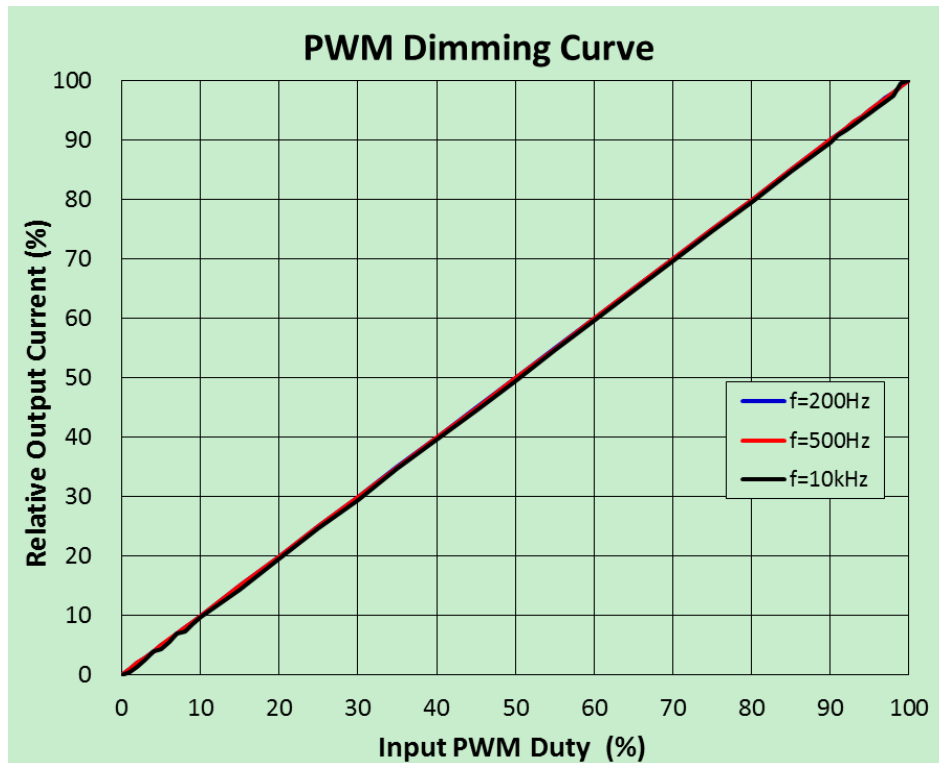
Location	Description	Package
R2	Resistor, SMT, 0 ohm, 0603, 5%	0603
R3	Resistor, SMT, 51K ohm, 0805, 5%	0805
R4,R5	Resistor, SMT, 0.2 ohm, 1206, 1%	1206
R1,R6	Resistor, SMT, 20 ohm, 0805, 5%	0805
C2,C3,C5,C6	Cap, Cer, GCJ32DC72A475KE01L, 4.7uF, 100V, X7S, 1210, -55°C~125°C, AEC-Q200, Murata	1210
C1,C4,C7,C9	Cap, Cer, CGA4J2X7R2A104K125AA, 100nF,100V,X7R, 0805, -55°C~125°C, AEC-Q200,TDK	0805
C15,C16	Cap, Cer, CGA3E2X7R2A103K080AA, 10nF, 100V, X7R, 0603, -55°C~125°C, AEC-Q200, TDK	0603
C17,C18	Cap, Cer, CGA3E2X7R2A102K080AA, 1nF, 100V, X7R, 0603, -55°C~125°C, AEC-Q200, TDK	0603
C10,C11	Cap, Cer, CL21C681JCC1PNC, 680pF, 100V, NPO, 0805, -55°C~125°C, AEC-Q200, Samsung	0805
C12,C13	Cap, Cer, CGA4J3X7R1H105K125AB, 1uF, 50V, X7R, 0805, -55°C~125°C, AEC-Q200, TDK	0805
C14,C20	Cap, Cer, CGA4J2X8R1H104K125AA, 100nF, 50V, X8R, 0805, -55°C~150°C, AEC-Q200, TDK	0805
C19	Cap, Cer, GCD188R71H102KA01D, 1nF, 50V, X7R, 0603, -55°C~125°C, AEC-Q200, Murata	0603
U1	IC, AL8862QSP-13, AEC-Q100 Qualified, DIODES,	SO-8EP
B1,B2,B3,B4	78279221601, 600ohm@100MHz, AEC-Q200, Würth Elektronik	1206
L1	744778004, 4.7uH, Isat=4.2A, 7.3x7.3x2.8mm, AEC-Q200, Würth Elektronik	SMT
L2	744373965150,15uH, Isat=10.2A, 13.65x12.5x6.2mm, AEC-Q200, Würth Elektronik	SMT
D2,D3	Diode, SBR8M100P5Q-13,8A,100V, AEC-Q101 Qualified, DIODES	POWER DI5
DIM, FAULT,GND	Connector, Orange color	DIP
LEDK	Connector, Black color	DIP
BAR-	Connector, White color	DIP
LEDA, BAR+	Connector, Red color	DIP

**System Performance**



**PWM Dimming Curve**

Test @VIN=12V, LED voltage=5.3V



**Waveforms:**

Turn ON@12V

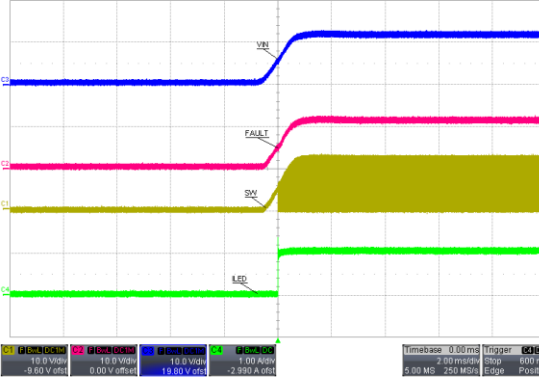
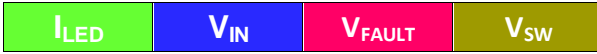


Figure 6. Startup @ Output =1 LED

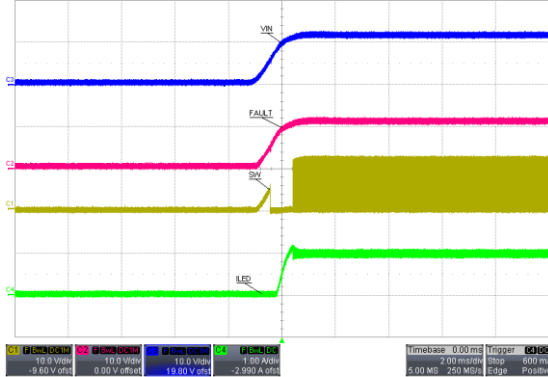


Figure 7. Startup @Output =3 LEDs

Turn OFF:

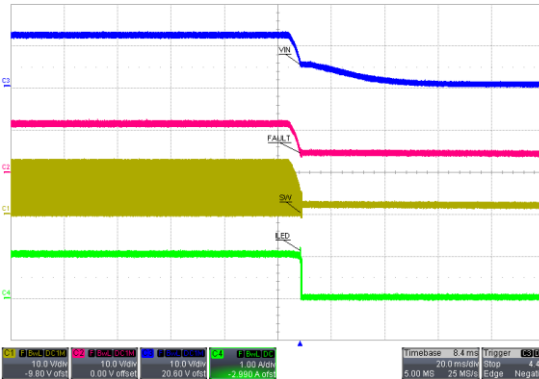


Figure 8. Turn off @Output =1 LED

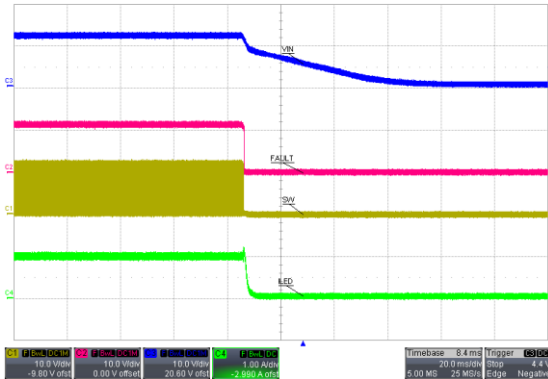


Figure 9. Turn off @Output =3 LEDs

Stable waveforms:

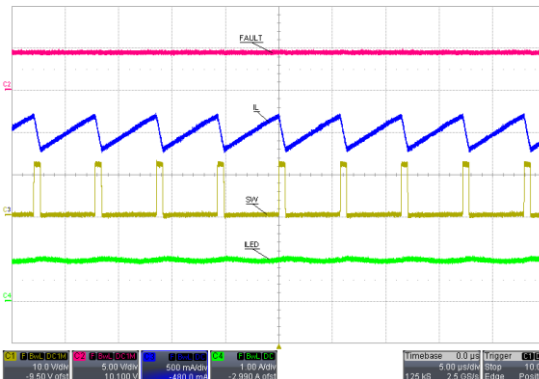
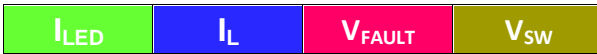


Figure 10. @Output =1 LED

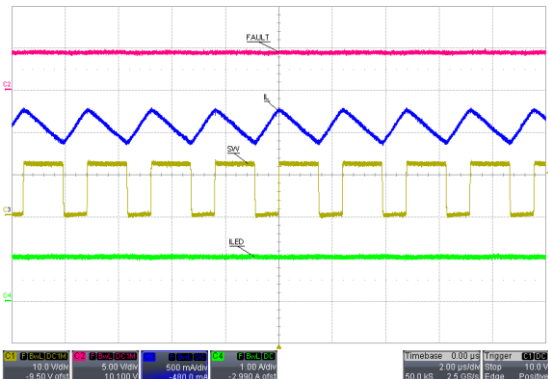
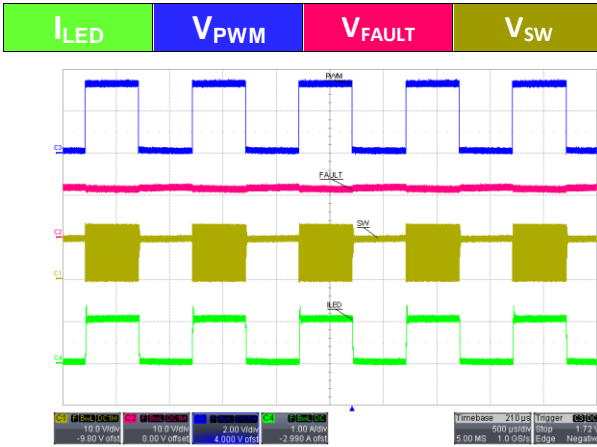
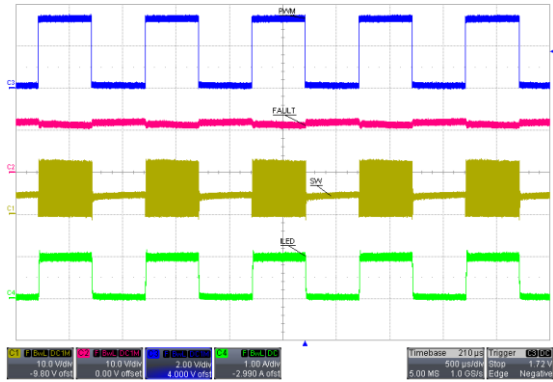


Figure 11. @Output =3 LEDs

**PWM Dimming Waveforms, PWM duty =50%**

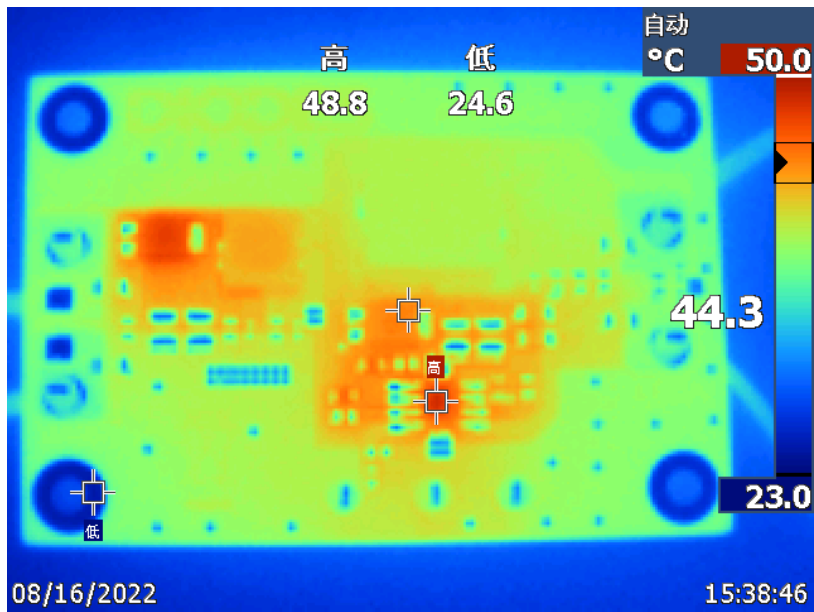


**Figure 12. Output =1 LED**



**Figure 13. Output =3 LEDs**

**Thermal Test:**

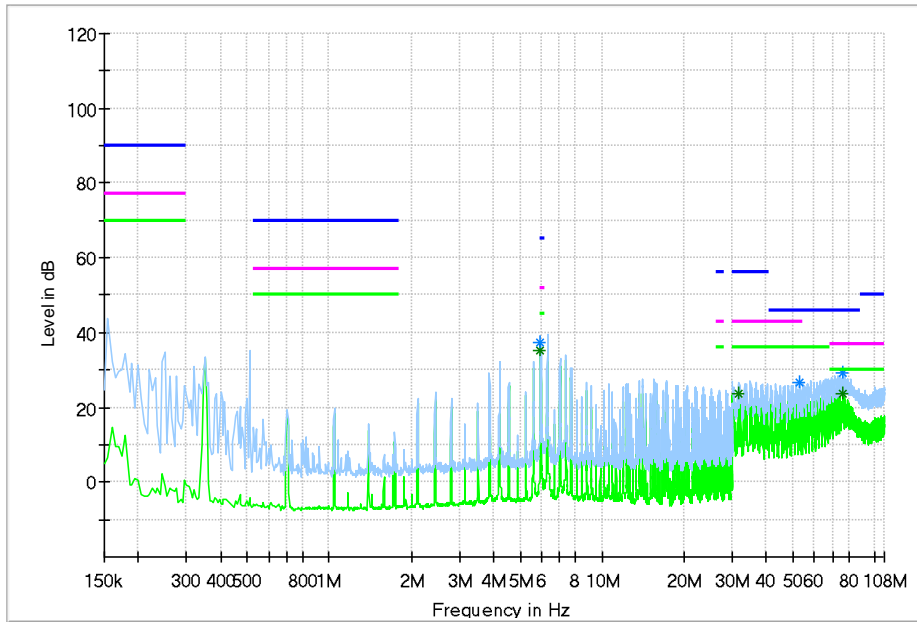


**IC Tc = 48.8C degree @ ambient = 23C degree, temperature rise is 25.8C degree.**

**Tested in VIN=13.5V, VLED=9.5V.**

### Conductive Emission Test:

Tested in VIN=13.5V, loading with 3pcs LED (Vo =9.5V)



Frequency	MaxPeak	Average	Limit	Margin	Meas._Time	Bandwidth	Line	Corr.
MHz	dB $\mu$ V	dB $\mu$ V	dB $\mu$ V	dB	ms	kHz		dB
5.95	---	35.38	45.00	9.62	---	---	Single Line	0.1
5.955	37.50	---	65.00	27.50	---	---	Single Line	0.1
31.800	---	23.56	36.00	12.44	---	---	Single Line	0.2
53.000	26.50	---	46.00	19.50	---	---	Single Line	0.2
75.800	---	23.68	29.98	6.30	---	---	Single Line	0.4
75.800	29.09	---	46.00	16.91	---	---	Single Line	0.4



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