

General Description

The AL5871Q is an automotive-grade single-channel linear LED driver with PWM dimming and analog dimming control. It can drive up to 750mA and the LED current can be set by the low-power reference resistor connected to the REF pin.

The device regulates LED current accuracy down to $\pm 4\%$ with excellent PWM and analog dimming performance. It enters standby mode to save power if no PWM signal is detected.

The AL5871Q monitors temperature and reduces the LED current if the chip temperature exceeds the threshold temperature. Moreover, the input undervoltage lock-out (UVLO), LED string open/short protection, overtemperature protection (OTP), and fault indicator (FAULTB) are designed to improve system robustness. The FAULTB pin is pulled low if any protection feature is activated.

Applications

- Automotive interior lighting:
 - Dome lights, reading lamps
- Automotive exterior lighting:
 - Small lights: blind-spot detection indicators, charging inlets, door handles
 - Rear lights: rear lamps, center high mounted stop lamps, side markers

Key Features

- Wide Input Voltage Range from 5V to 55V
 - Up to 750mA Current Drive Capability (in 25°C ambient)
 - Maximum Dropout: 100 mV at 100 mA
 - Maximum Dropout: 140 mV at 150 mA
 - Maximum Dropout: 280 mV at 300 mA
 - Maximum Dropout: 690 mV at 750 mA
 - Output Current Adjustable by a Low-Power External Reference Resistor
 - PWM and Analog Dimming with Excellent Linearity
 - Automatically Enter and Exit Standby Mode without Enable Pin
 - Internal Protections:
 - Input Undervoltage Lock-Out (UVLO)
 - LED String Open Protection
 - LED String Short Protection
 - Overtemperature Protection (OTP)
 - Diagnostic enable with adjustable threshold for low-dropout operation
 - Thermal Fold-Back if Chip Temperature Exceeds the Threshold
 - Fault Reporting: UVLO, OTP, LED Open, and LED Short
 - **Totally Lead-Free & Fully RoHS Compliant**
 - **Halogen and Antimony Free. “Green” Device**
 - **The AL5871Q is suitable for automotive applications requiring specific change control; this part is AEC-Q100 qualified, PPAP capable, and manufactured in IATF16949 certified facilities.**
- <https://www.diodes.com/quality/product-definitions/>

Specifications

Parameter	Value
Input Voltage	5VDC to 55VDC
LED Current	375mA
LED Current	375mA single Channel
Number of LEDs	1~15pcs
XY Dimension	61.5mm x 43.2mm

Configuration



Figure 1: Top View

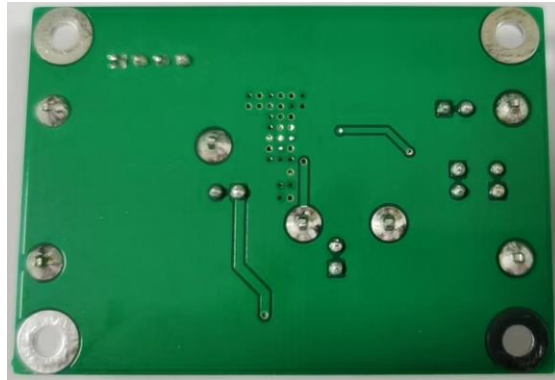


Figure 2: Bottom View

Connection Instructions and Quick Start Guide

1. Ensure that the DC source is switched OFF or disconnected before soldering or connecting.
2. By default, the evaluation board's LED current is preset at 375mA output.
3. Connect the anode wire of the external LED string to the LED+ connector.
4. Connect the cathode wire of the external LED string to the LED- connector.
5. Power Supply Input: 5–55VDC between **BAT+** and GND.
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. The LED string should light up.
8. For PWM dimming operation, remove the jumper on J1, and supply 200Hz–2kHz PWM signal on the PWM terminal.
9. For analog dimming operation, ensure J1 is shorted by the jumper, and supply a 0-1.5VDC signal on the ADIM terminal.
10. This board supports FAULTB signal output. Pull FAULTB to VIN by short J2 with a jumper, otherwise FAULTB is pulled high by the AL5871Q internal block.

Evaluation Board Schematic

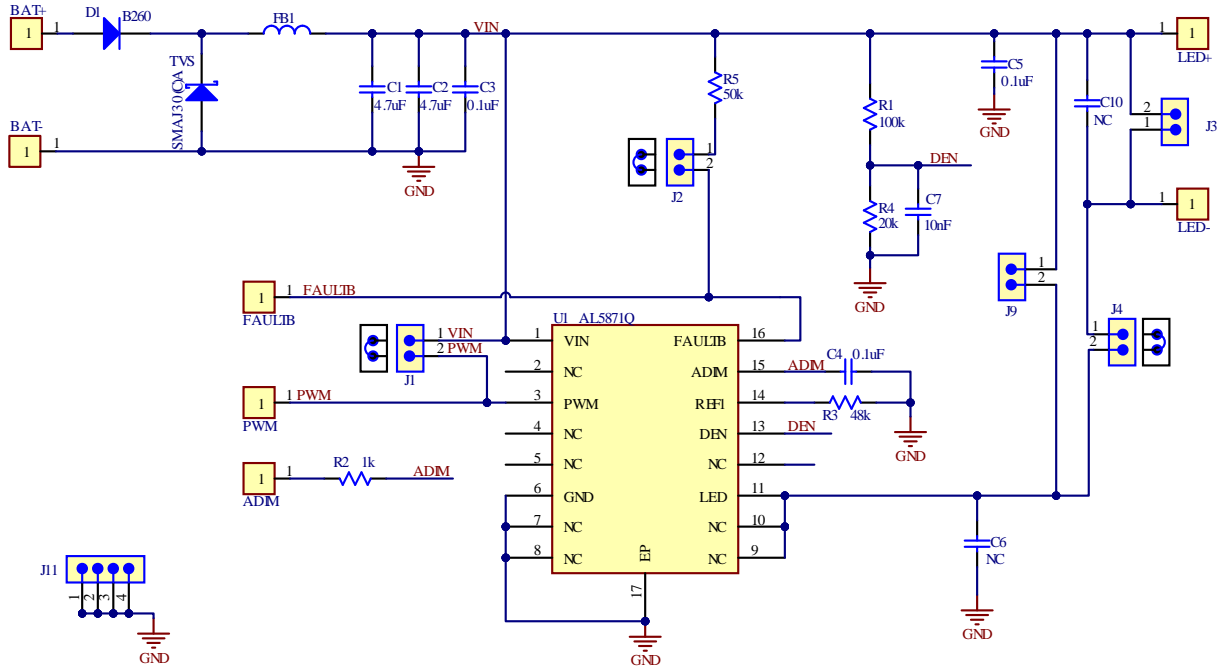


Figure 3: Evaluation Board Schematic

Evaluation Board Layout

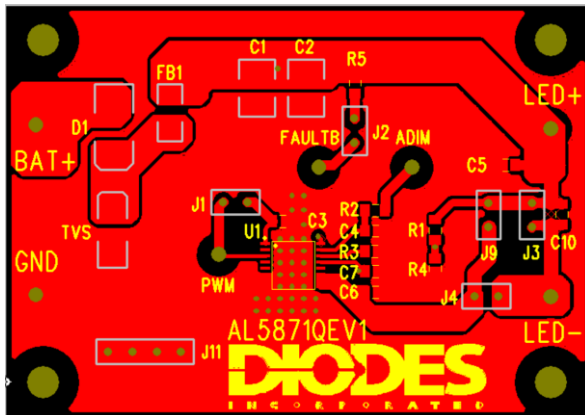


Figure 4: PCB Layout Top Layer View

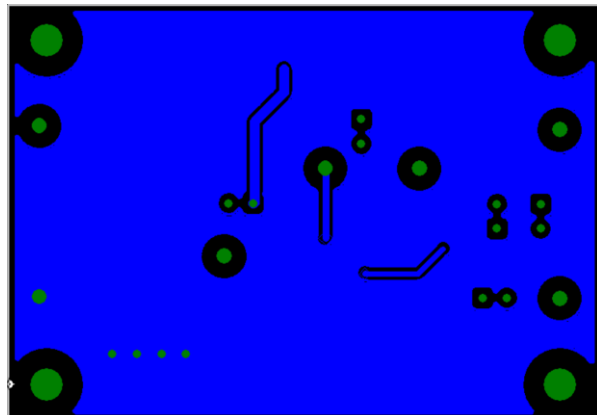


Figure 5: PCB Layout Bottom Layer View

Bill of Materials

Location	Description	Package
FB1	Resistor, SMT, 0R, 1206, 5%	1206
R7	Resistor, SMT, 10K,0805,5%	0805
R2	Resistor, SMT, 1K,0805,5%	0805
R3	Resistor, SMT, 47.5K,0805,1%	0805
R1	Resistor, SMT, 100K, 0805, 1%	0805
R4	Resistor, SMT, 20K, 0805, 1%	0805
R5	Resistor, SMT, 51K, 0805, 5%	0805
C1, C2	Cap, Cer, CNA6P1X7R2A475K250AE, 4.7uF, 100V, X7R, 1210, -55°C~125°C, AEC-Q200, Murata	1210
C3, C5	Cap, Cer, CGA4J2X7R2A104K125AA, 100nF,100V,X7R, 0805,-55°C~125°C, AEC-Q200,TDK	0805
C7	Cap, Cer, CGA4C2C0G1H103J060AA,10nF,50V,X7R, 0805,-55°C~125°C, AEC-Q200,TDK	0805
C4	Cap, Cer, CGA4J2X8R1H104K125AA, 100nF,50V,X7R, 0805,-55°C~125°C, AEC-Q200,TDK	0805
D1	Diode,B260Q,SMB,60V,2A,DIODES	SMB
TVS	SMAJ36AQ,400W Surface Mount Transient Voltage Suppressor,DIODES	SMA
U1	IC,AL5871Q, DIODES	TSSOP-16EP
FAULTB, LED+	Connector, Orange color	DIP
GND	Connector, Black color	DIP
PWM, ADIM, LED-	Connector, White color	DIP
BAT+	Connector, Red color	DIP
J1, J2, J3, J4	Connector,2pin, pitch=2.54mm	DIP
J11	Connector,4pin, pitch=2.54mm	DIP
J1, J2, J4	Jumper,2pin, pitch=2.54mm	DIP

Operating Waveforms

Turn On & Off

System turns on by VIN with 100% brightness

Test condition: VIN=12V, 3 LEDs (ILED=375mA), PWM=100% duty

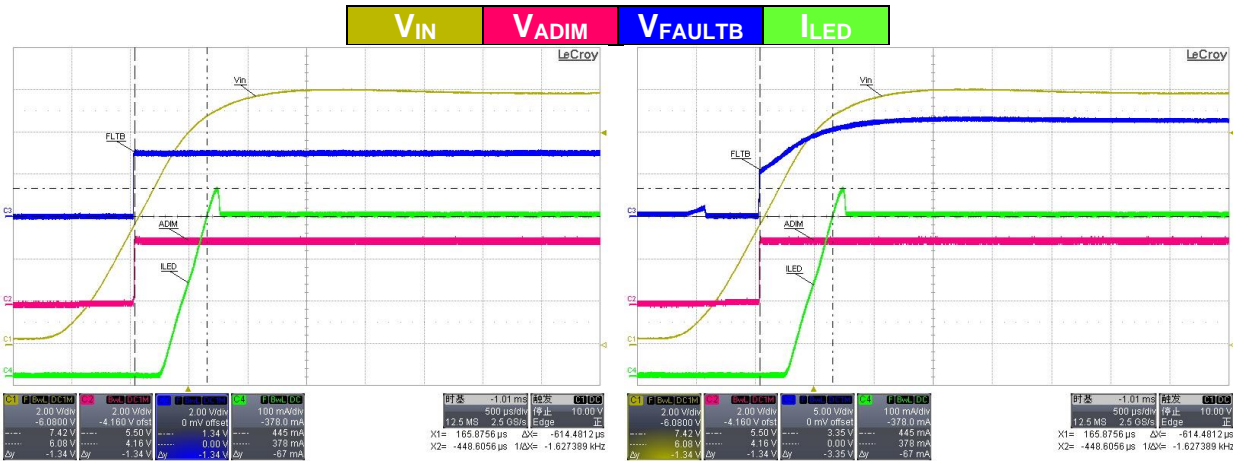


Figure 6 Turn on @ FAULT floating

Figure 7 Turn on @ FAULT pull up by 50k

System turns on by VIN under analog dimming

Test condition: VIN=12V, 3 LEDs (ILED=375mA)

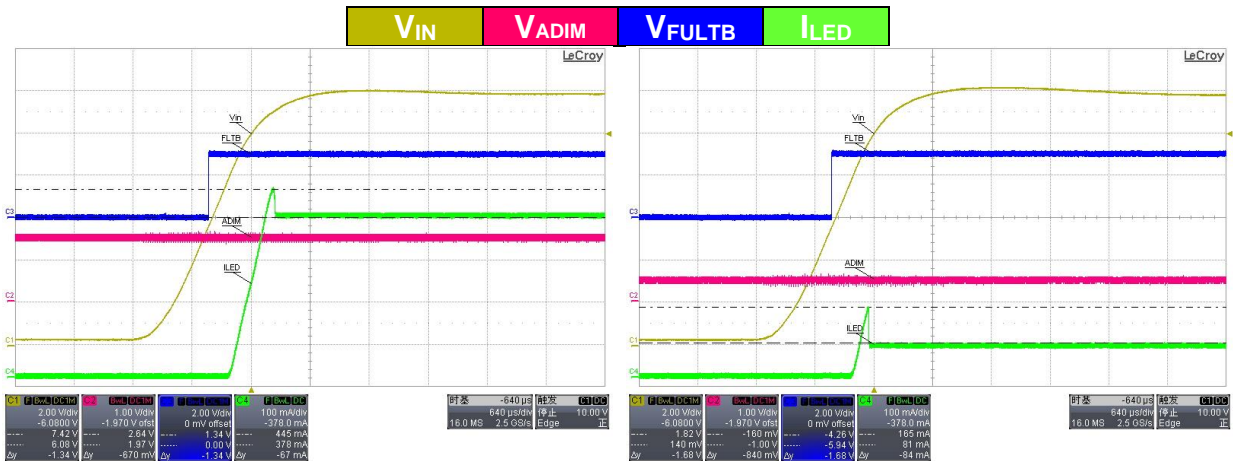


Figure 8 Turn on @ VADIM=1.5V

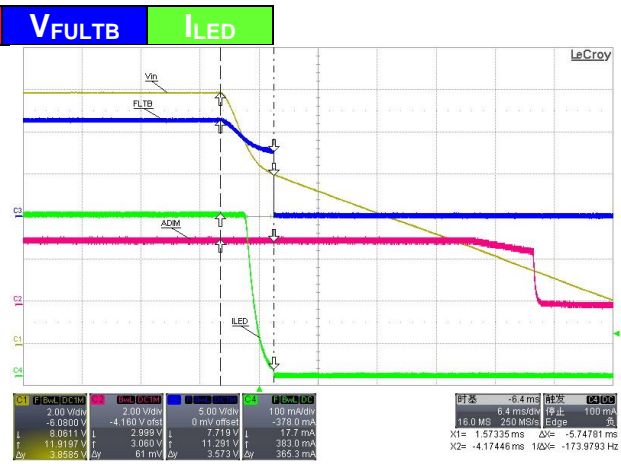
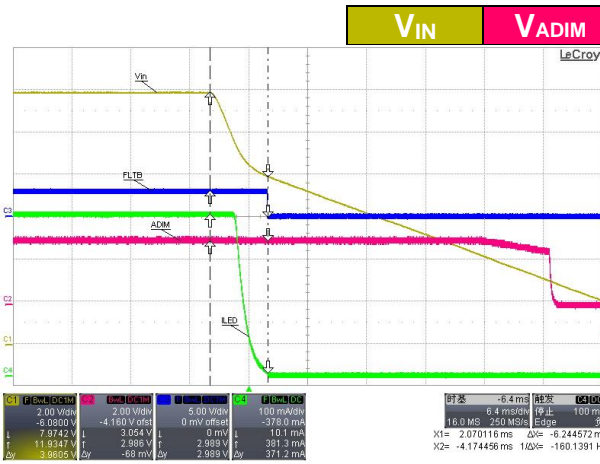
Figure 9 Turn on @ VADIM=0.5V

Operating Waveforms (continued)

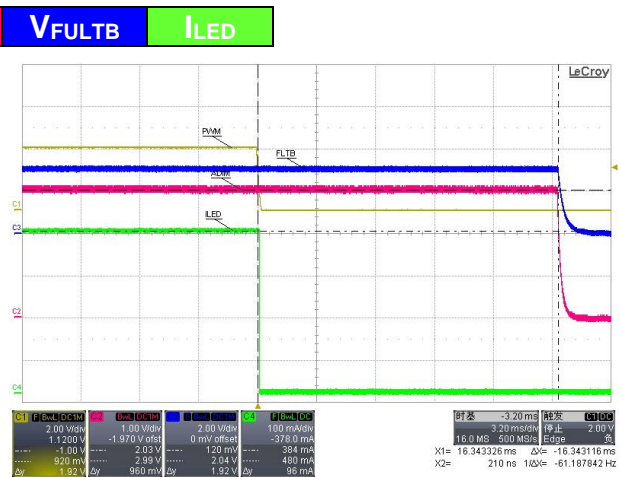
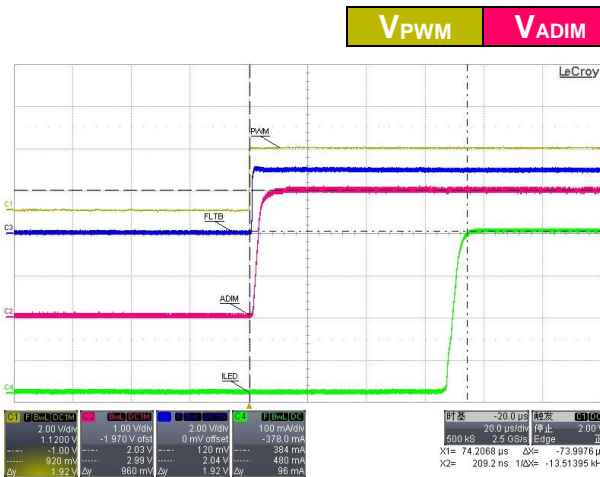
Turn On & Off

System turns off by VIN with 100% brightness

Test condition: VIN=12V, 3 LEDs (ILED=375mA), PWM=100% duty



System turn on/off by PWM with 100% brightness

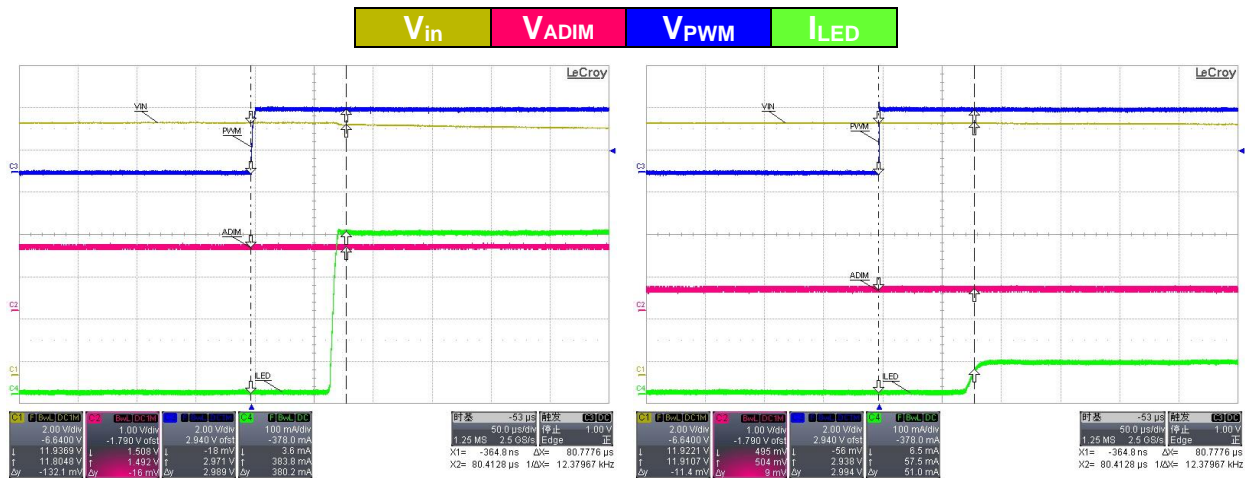


Operating Waveforms (continued)

Turn On & Off

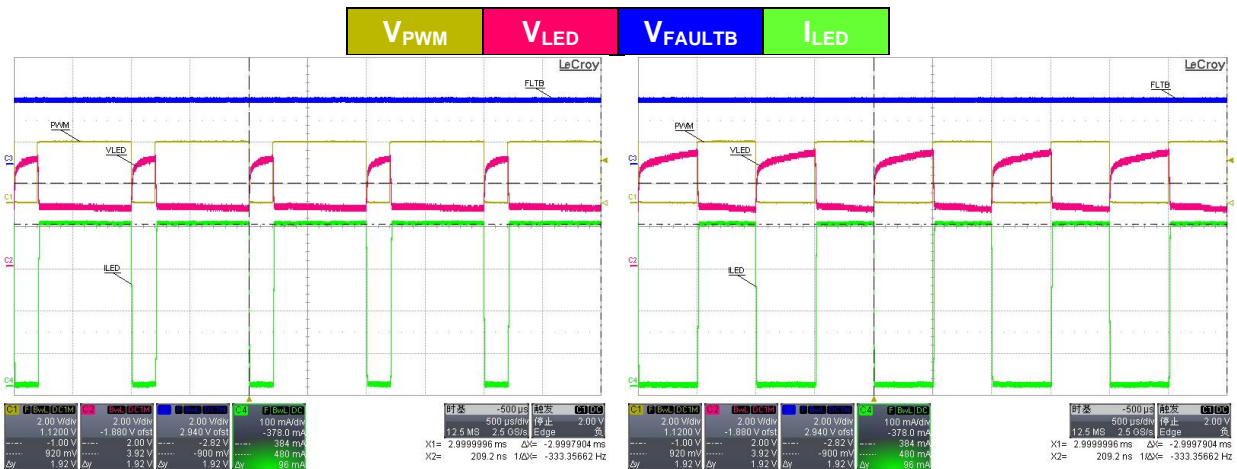
System turns on by PWM under analog dimming

Test condition: VIN=12V, 3 LEDs (ILED=375mA)



Stable Operation

PWM Dimming: 1kHz



Operating Waveforms (continued)

Analog Dimming

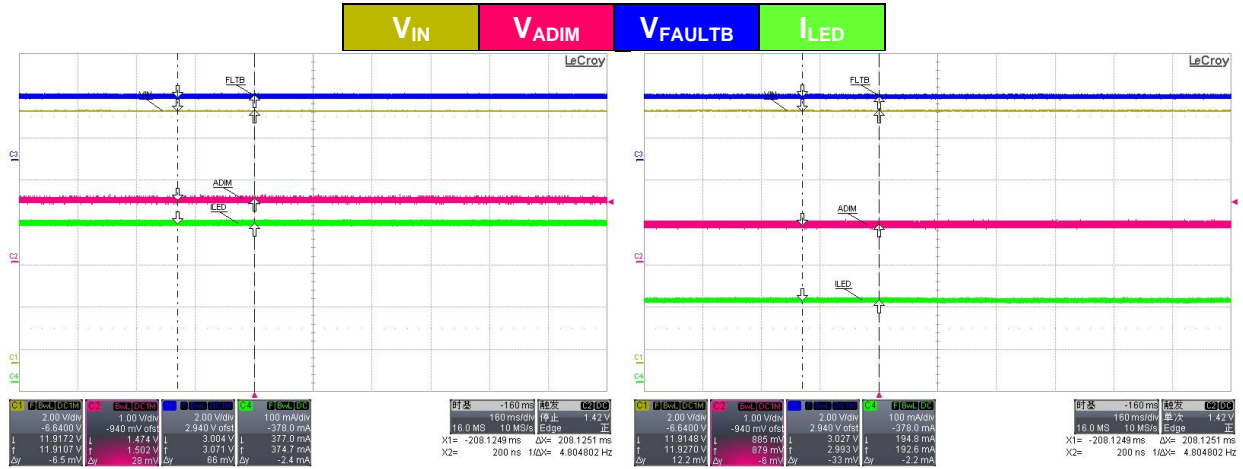


Figure 18 VADIM=1.5V

Figure 19 VADIM=0.9V

Dimming Curve

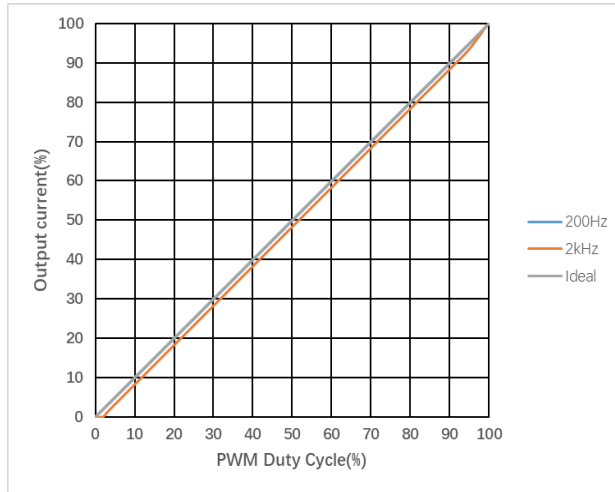


Figure 20 PWM Dimming Curve

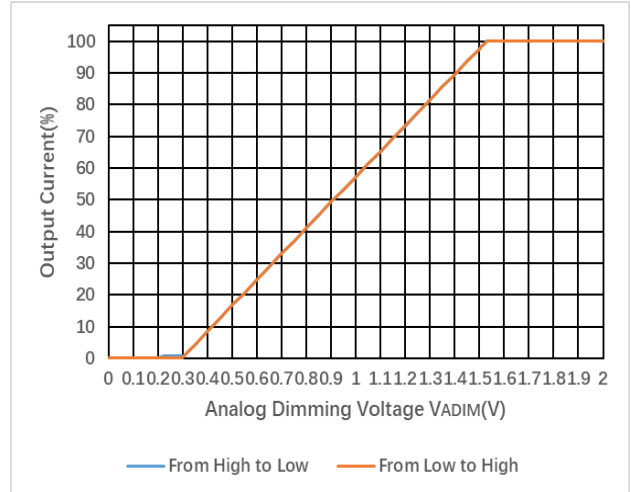


Figure 21 Analog Dimming Curve

BCI Test

EVB passes ISO11452-4 200mA BCI testing without LED flickering and output current decreasing.

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