



# EV3309-QG-00A

## 40mA, Synchronous Boost White LED Driver with I<sup>2</sup>C Interface Evaluation Board

### DESCRIPTION

The EV3309-QG-00A is designed for the MP3309, a WLED driver. The device has a 2.7V to 5.5V input voltage range and uses peak current mode control to regulate the LED current sensed through an external, low-side resistor. Synchronous rectification and the 200mV feedback voltage reduce power loss and PCB size. To save driver losses, select non-synchronous mode by using an internal register to disable the rectifier MOSFET.

The MP3309 features a configurable switching frequency to optimize efficiency. It supports both analog and PWM dimming.

In addition, the MP3309 has LED open protection, cycle-by-cycle current limit protection, under-voltage protection (UVP), and thermal shutdown protection. The I<sup>2</sup>C interface can set the protection indication bits and the over-voltage protection (OVP) threshold.

The MP3309 is available in a QFN-10 (1.4mmx1.8mm) package

### ELECTRICAL SPECIFICATIONS

| Parameter      | Symbol           | Value      | Units |
|----------------|------------------|------------|-------|
| Input voltage  | V <sub>IN</sub>  | 2.7 to 5.5 | V     |
| Output voltage | V <sub>LED</sub> | <35        | V     |
| LED current    | I <sub>LED</sub> | 40         | mA    |

### FEATURES

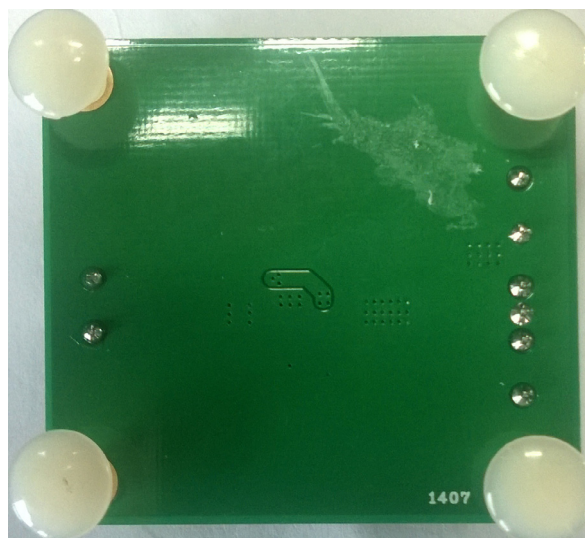
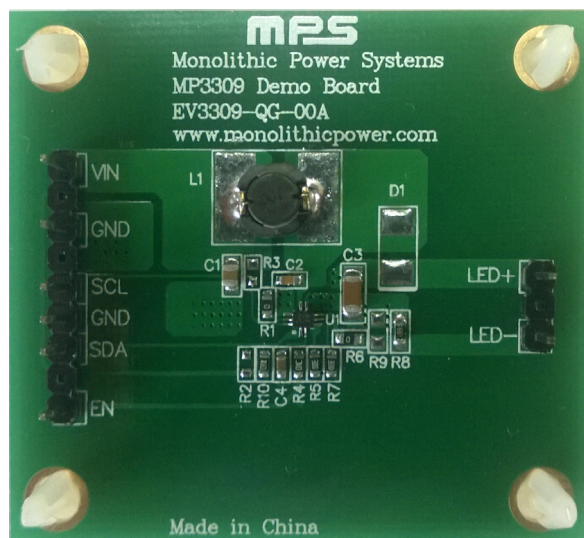
- 2.7V to 5.5V Input Voltage Range
- Analog and PWM Dimming
- Selectable Synchronous or Non-Synchronous Mode
- 400kHz I<sup>2</sup>C-Compatible Interface
- Digitally Set LED Current
- Configurable Switching Frequency
- Configurable Over-Voltage Protection (OVP) Threshold
- Low 200mV Feedback Voltage with  $\pm 1\%$  Accuracy
- Software or Hardware Enable Function
- Internal Soft Start
- Under-Voltage Lockout (UVLO), Thermal Shutdown, and Over-Current Protection (OCP)
- The MP3309 Supports Default Analog Dimming (PWMH) via the External PWM Signal Input
- The MP3309C Provides a Default I<sup>2</sup>C Interface
- Available in a QFN-10 (1.4mmx1.8mm) Package

### APPLICATIONS

- Feature Phones and Smartphones
- Tablets
- <10inch Video Displays

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## EV3309-QG-00A EVALUATION BOARD



LxWxH (5cmx4.6cmx1.0cm)

| Board Number  | MPS IC Number |
|---------------|---------------|
| EV3309-QG-00A | MP3309GQG     |

## **QUICK START GUIDE**

1. Place a voltage source (2.7 to 5.5V) between the VIN terminal and GND.
2. Connect the LED strings between LED+ and LED-.
3. Set the dimming mode.

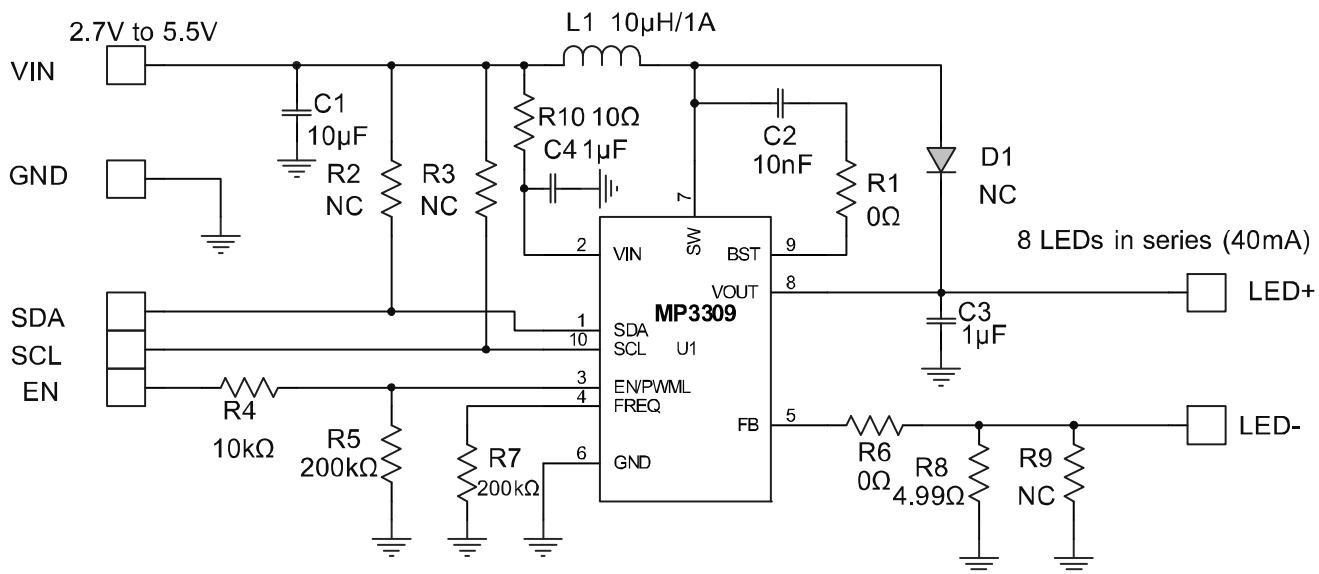
### **Analog Dimming**

1. Pull the EN/PWML pin to logic high. To select analog dimming for different ICs, follow the instructions below:
  - a. MP3309: the default analog dimming is set by an external PWM input. For analog dimming, connect the SCL and SDA pins together to act as PWMH, then add a >20kHz PWM signal to PWMH.
  - b. MP3309C: the MP3309C can work with the I<sup>2</sup>C interface. Control the dimming via register 00h, bits[D0:D4]. Set the EN bit to 1 before dimming.

### **PWM Dimming**

1. Connect the SCL and SDA pins together, then pull these pins to logic high.
2. Apply a 200Hz to 2kHz PWM signal to the EN/PWML pin.
3. To select the output current using a resistor on the FB pin, see the related IC datasheet for more details.

## EVALUATION BOARD SCHEMATIC



**Figure 1: Evaluation Board Schematic**

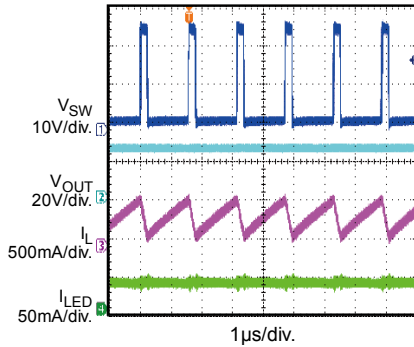
## EV3309-RT-00A BILL OF MATERIALS

| Qty | Ref        | Value         | Description                         | Package              | Manufacturer | Manufacturer P/N      |
|-----|------------|---------------|-------------------------------------|----------------------|--------------|-----------------------|
| 1   | C1         | 10 $\mu$ F    | Ceramic capacitor, 6.3V, X7R        | 0805                 | Murata       | GCM21BR70J106KE2      |
| 1   | C2         | 10nF          | Ceramic capacitor, 50V, X7R         | 0603                 | Murata       | GRM188R71H103KA01D    |
| 1   | C3         | 1 $\mu$ F     | Ceramic capacitor, 50V, X7R         | 1206                 | Murata       | GRM31MR71H105KA88L    |
| 1   | C4         | 1 $\mu$ F     | Ceramic capacitor, 6.3V, X5R        | 0603                 | Murata       | GRM188R60T105KA01D    |
| 1   | D1         | NC            |                                     |                      |              |                       |
| 1   | L1         | 10 $\mu$ H    | Inductor, 1.14A, DCR = 59m $\Omega$ | SMD                  | Toko         | D63LCB-A921CY-100M=P3 |
| 2   | R1, R6     | 0 $\Omega$    | Resistor, 0 $\Omega$ , 5%           | 0603                 | Yageo        | RC0603JR-070RL        |
| 1   | R10        | 10 $\Omega$   | Resistor, 10 $\Omega$ , 1%          | 0603                 | Yageo        | RC0603FR-0710RL       |
| 3   | R2, R3, R9 | NC            |                                     |                      |              |                       |
| 2   | R5, R7     | 200k $\Omega$ | Resistor, 200k $\Omega$ , 1%        | 0603                 | Yageo        | RC0603FR-07200KL      |
| 1   | R4         | 10k $\Omega$  | Resistor, 10k $\Omega$ , 1%         | 0603                 | Yageo        | RC0603FR-0710KL       |
| 1   | R8         | 4.99 $\Omega$ | Resistor, 4.99 $\Omega$ , 1%        | 0603                 | Yageo        | RC0603FR-074R99L      |
| 1   | U1         | MP3309        | White LED driver                    | QFN-10 (1.4mmx1.8mm) | MPS          | MP3309GQG             |

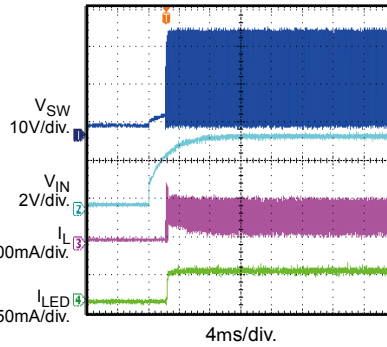
## EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.  $V_{IN} = 3.6V$ , 8 LEDs in series,  $I_{LED} = 40mA$ ,  $L = 10\mu H$ ,  $T_A = 25^\circ C$ , unless otherwise noted.

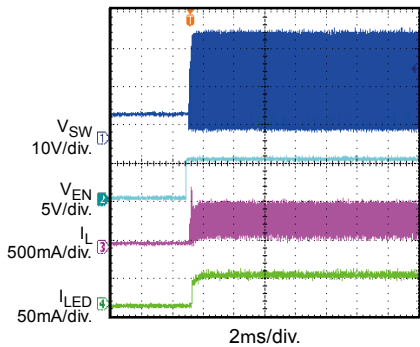
### Steady State



### Start-Up through VIN

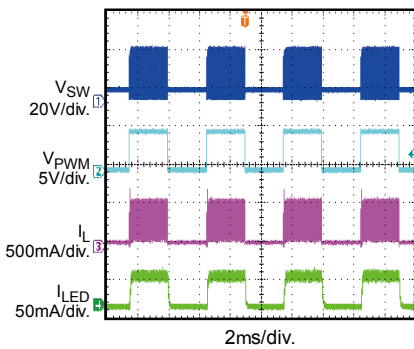


### Start-Up through EN



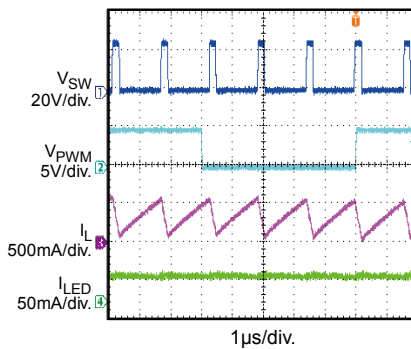
### PWM Dimming

$f_{DIM} = 200Hz$ ,  $D_{DIM} = 50\%$

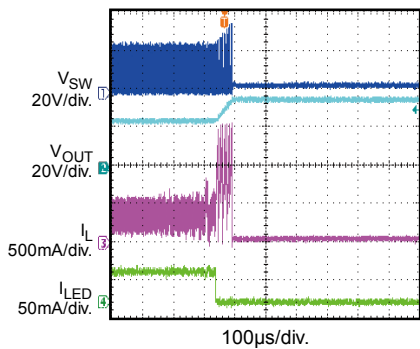


### Analog Dimming

$f_{DIM} = 20kHz$ ,  $D_{DIM} = 90\%$

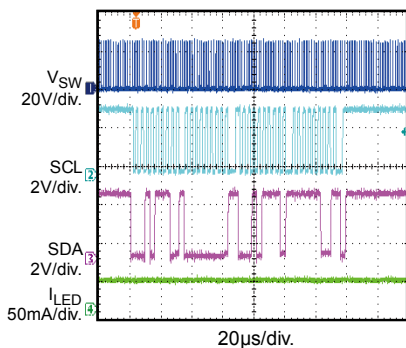


### Open LED Protection



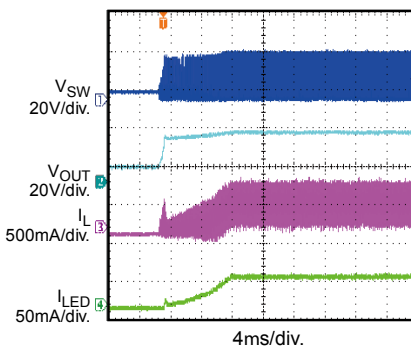
### Set $I_{LED}$ via the I<sup>2</sup>C

For the MP3309C



### Set Enable Bit to 1

For the MP3309C



## PCB LAYOUT

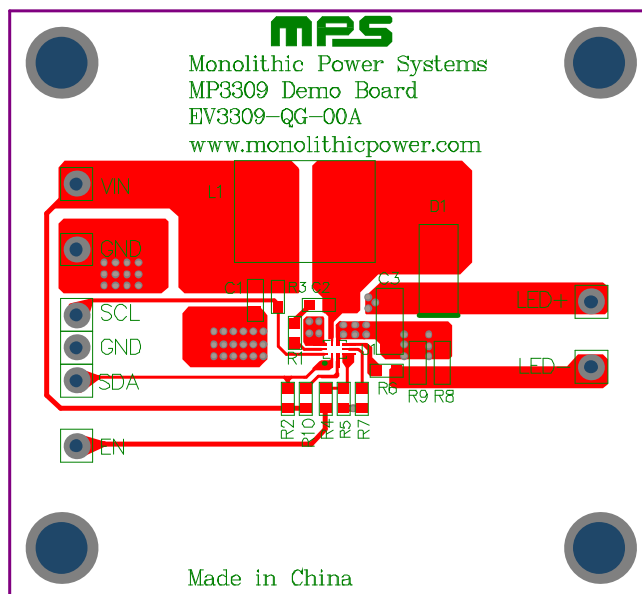


Figure 2: Top Layer

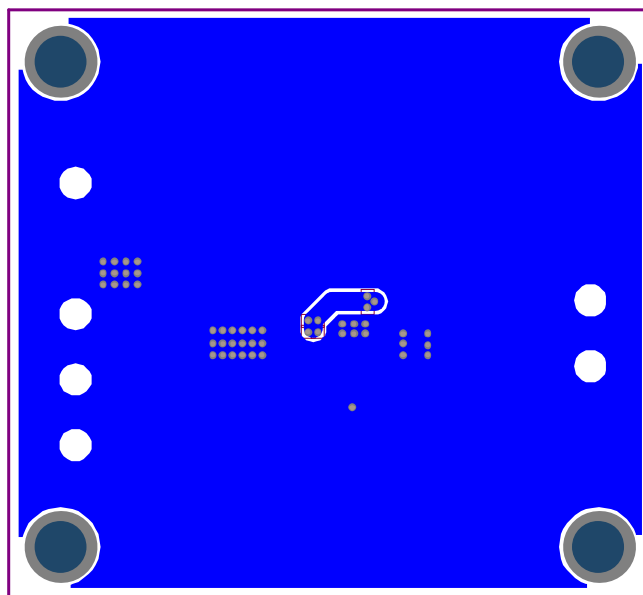


Figure 3: Bottom Layer



## Revision History

| Revision # | Revision Date | Description         | Pages Updated |
|------------|---------------|---------------------|---------------|
| 1.0        | 06/19/2014    | Initial Release     | -             |
| 1.1        | 03/13/2015    | EVB waveforms added | P6            |
| 1.2        | 02/24/2021    | Grammar review      | All           |

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