

3. Open Circuit of LED string

The AL8860Q has by default open LED protection. Figure 2 shows the operation when LED string open circuit happens and then LED string is reconnected. If the LED string is open circuit, the AL8860Q will stop oscillating and the SW pin will fall to GND. No excessive voltages will be seen by the AL8860Q and no damages will be caused to the system. Once the LED string is reconnected, the AL8860Q will resume normal operation.

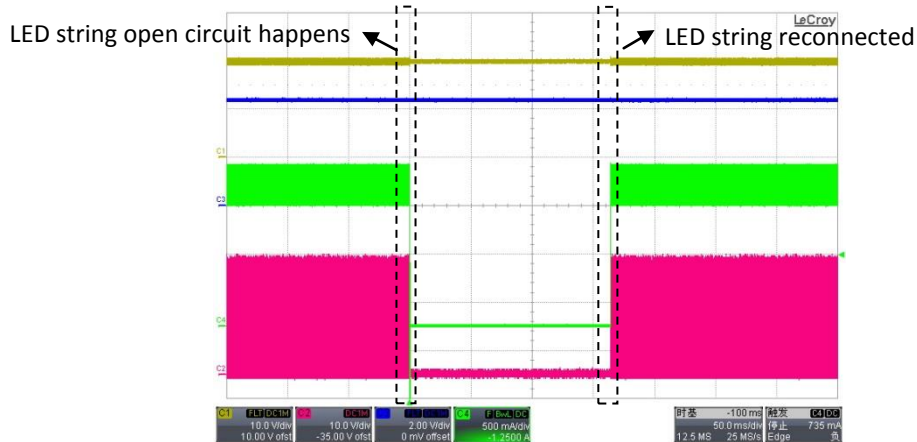


Figure 2. LED open protection (Vin=20V, 3LEDs)
(Y-Vin, B-CTRL, G-IL, R-SW)

4. Short Circuit of LED string

If the LED string should become shorted together (the anode of the top LED becomes shorted to the cathode of the bottom LED), the AL8860Q will continue to switch and the current through the AL8860Q's internal switch will still be at the regulated current - so no excessive heat will be generated within the AL8860Q. However, the duty cycle at which it operates will change dramatically and the switching frequency will most likely decrease.

Figure 3 shows the operation when LED string short circuit happens. The on-time of the internal power MOSFET switch is significantly reduced because almost all of the input voltage is now developed across the inductor. The off-time is significantly increased because the reverse voltage across the inductor is now just the schottky diode voltage causing a much slower decay in inductor current.

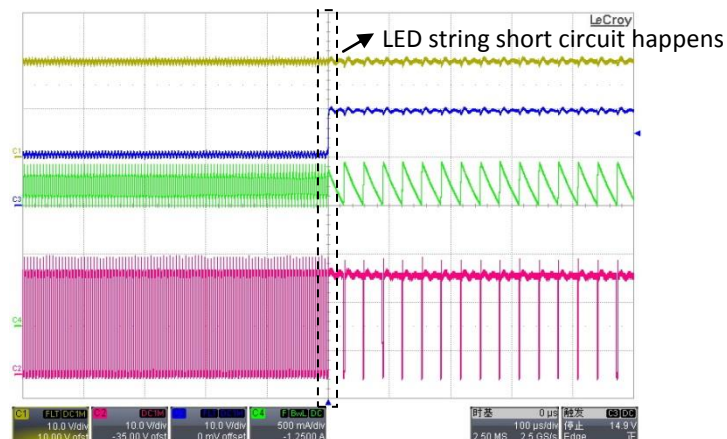


Figure 3. LED short protection (Vin=20V, 3LEDs)
(Y-Vin, B-LED K, G-IL, R-SW)

5. LED anode shorted to GND consideration

LED drivers and power supplies can be remote mounted from the LED modules. The remote mounting distance is based on the voltage drop generated across the supply leads. The voltage drop will vary based on the operating current and the gauge wire used. Typically a maximum voltage drop of 1V across the output leads is acceptable. Table 1 shows the lead length based on the current and wire gauge that will generate a 1V drop.

Wire Gauge	Length of Wire (in feet) for 1V Drop				
	Operating Current (Amps)				
	0.350	0.700	1.050	1.400	5.0
18	447	224	149	112	31
16	711	356	237	178	50
14	1132	566	377	283	79

Table 1. Remote Mounting Distance Chart

When LED string is on a separate board away from the AL8860Q driver board, there may be chances that the anode terminal of the AL8860Q driver board is shorted to GND by misconnection. To avoid damage from this event, a fuse resistor can be added at the input. See Figure 4, if LED anode is shorted to GND, the input power supply will be connected to GND via fuse (F1) and sense resistor (R1, R2), and the current flowing through F1 is $V_{in}/(R1/R2)$, which is high enough to blow out the fuse to cut off the current path.

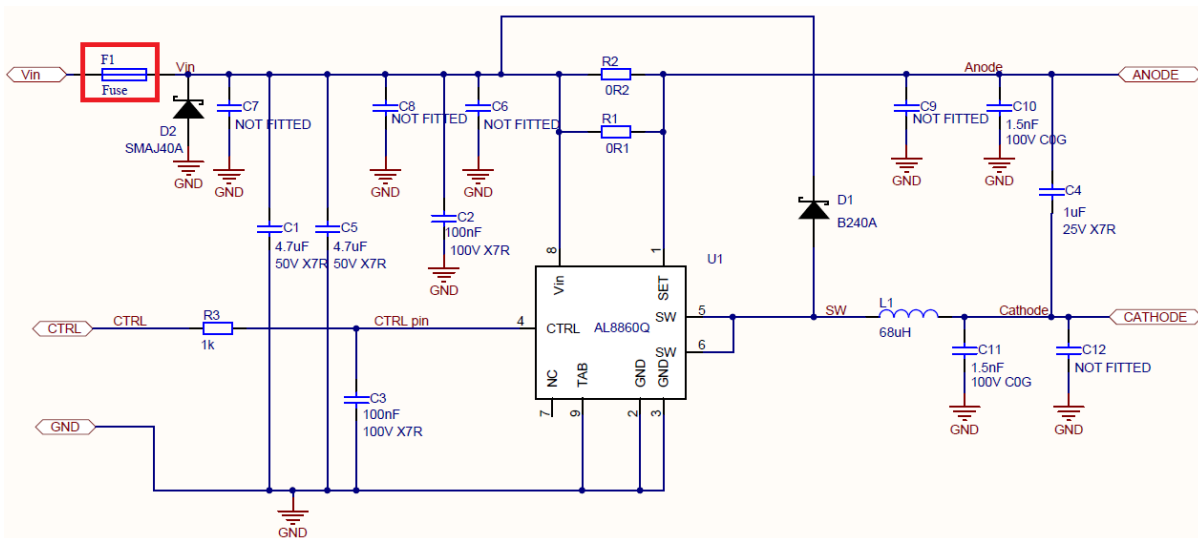


Figure 4. Solution for LED anode shorted to GND

6. Summary

It has been demonstrated how the AL8860Q reacts when fault status occurs. The AL8860Q is capable of providing robust protections against LED open, LED short and LED anode short to GND, ensuring safety and reliability in automotive applications.

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