AL58263EV1 User Guide

16-Channel LED Driver With 16-bit APDM Control

Description

The AL58263 is a 16-channel constant current LED driver with 16-bit grayscale Adaptive Pulse Density Modulation (APDM), supports error diagnostics, power saving function and current gain control. This distinctive APDM technology abates the non-ideal IOUT distortion due to non-symmetric transient responses and enhances the refresh rate by separating efficiently the frame waveform.

The device operates over a 3V to 5.5V input voltage range, 15V output channel voltage, a fast 25MHz data clock (DCK) serial input, delivers up to 55mA of high accuracy current to each string of LED. Each channel output current can be programmable thru digital interface individually. All channels output current could be set by one external sensing resistor along with 6-bit global current control register.

The AL58263 has built-in diagnosis and LED open/short protection and error detection, those errors results are stored in register for MCU to read out.

The AL58263 is available in the TSSOP-24EP (Type A1-B) package and specified over the -40°C to +85°C ambient temperature range.

Applications

- Indoor and Outdoor LED Video Displays
- Variable Message Sign (VMS)
- Traffic Sign
- Outdoor Billboard Signage
- LCD Display Backlighting

Features

- Input Voltage VDD: 3V to 5.5V
- Output Current Range
  - 2~55mA/5V, 2~35mA/3.3V
  - ±0.1% Output current regulation capability
  - 6-bit global current control: from 12.5% to 200%
- 16 Constant-Current Sink Output Channel
  - 16-bit grayscale resolution with Adaptive Pulse
  - Density Modulation control
  - 15V Rated output channels for long LED strings
  - Fast Transient Response – supports external grayscale clock with double edge up to 16MHz
  - ±1.5% (typical) LED Current accuracy between channels
  - ±3% (typical) LED Current accuracy between chips
  - Non-scramble waveform for high power LED application
  - Grayscale counter reset selection
  - Grayscale data synchronization selection
- Diagnosis and Protections
  - Error detection includes LED Open, LED Short, Output port leakage, Output short-to-GND, Output short-to-Power and REXT short-to-GND
  - Error detection LEDs on at 0.1mA to avoid any flickering
  - Short detection threshold voltage selection (2/3/4/4.5V)
  - Sleep and 0-data mode to lower down the supply current
  - Pre-Over-temperature warning
- 4-Wire Serial Interface (LAT, DI, DO, DCK)
  - 25MHz Clock frequency for data transfer
  - EMI reduction grayscale clock
  - Cascaded capability (Max 1,440 devices)
  - External GCK watchdog
  - Stagger outputs delay for EMI reduction
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1& 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative.**
  https://www.diodes.com/quality/product-definitions/

Hardware Description

The AL58263 evaluation board as shown in Figure 1 and Figure 2:

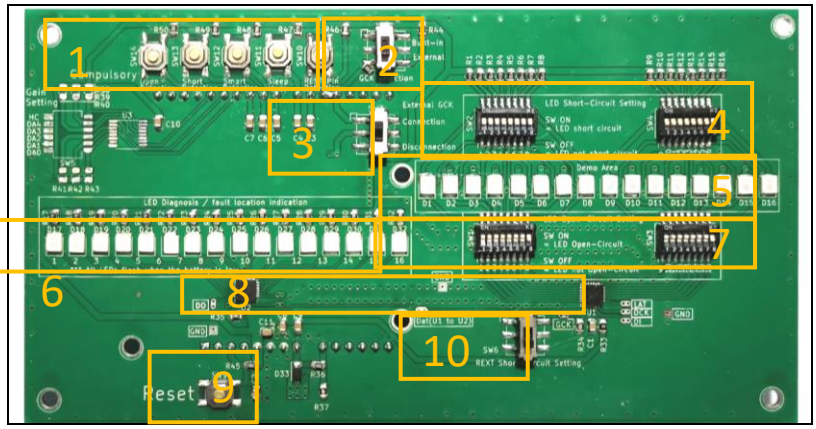

Figure 1. Top View

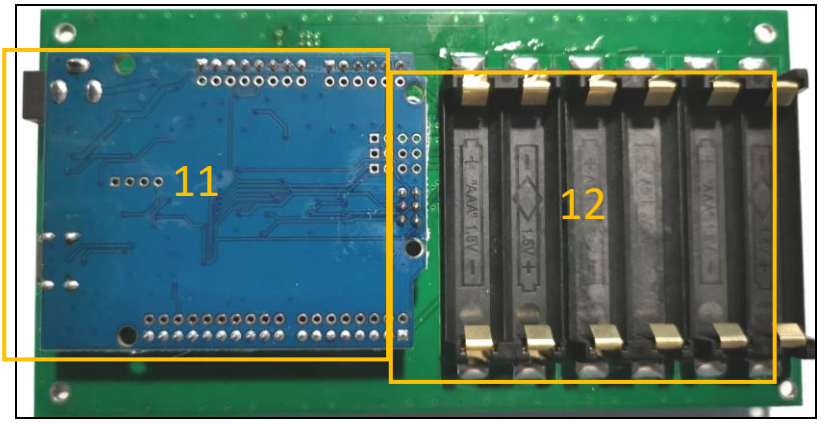

Figure 2. Bottom View

Section	Description
1	Mode Select button
2	GCK internal/external select switch
3	GCK external connect switch
4	LED Short Circuit Setting switch(default OFF)
5	LED Scrolling Mode display section
6	LED Diagnosis/Fault location section
7	LED Open Circuit Setting switch(default ON)
8	AL58263 16-Channel LED Driver
9	System Reset button
10	REXT Short Circuit Setting switch(default OFF)
11	Control board
12	AAA dry batteries box

Power Supply Options

The device features two power supply options:

1. Utilizing six AAA dry batteries for portable convenience.
2. Connecting the ARDUINO control board via the USB interface (type C) to serve as the power source.

Note: The two power supply methods cannot be used simultaneously.

Low Voltage Warning

In the event of insufficient voltage from the connected batteries (total voltage in series ranging from 6V to 7V), the "LED Fault Location (Status) Display Area" will present the BCD code of the total series voltage. This BCD code includes the tens digit of the voltage (LED1-4), the units digit of the voltage (LED5-8), the first decimal digit of the voltage (LED9-12), and the second decimal digit of the voltage (LED13-16).

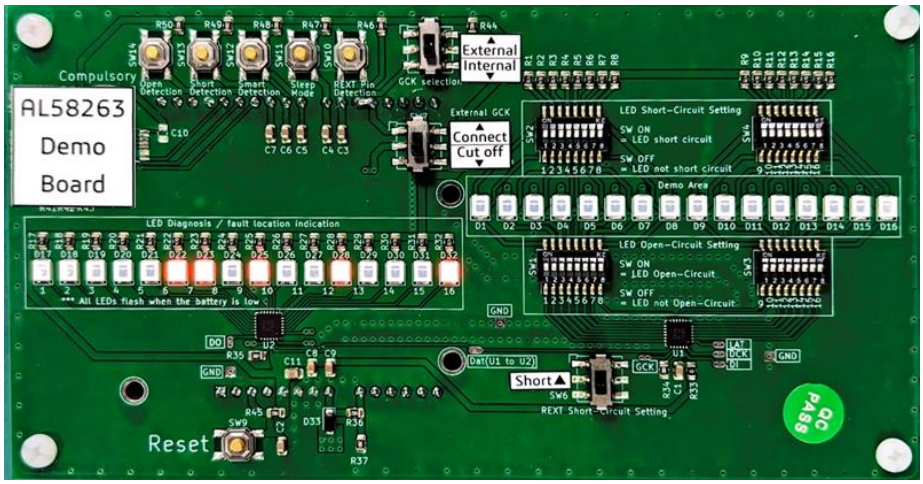

Figure 3. Low Voltage Warning (VIN = 6.9V)

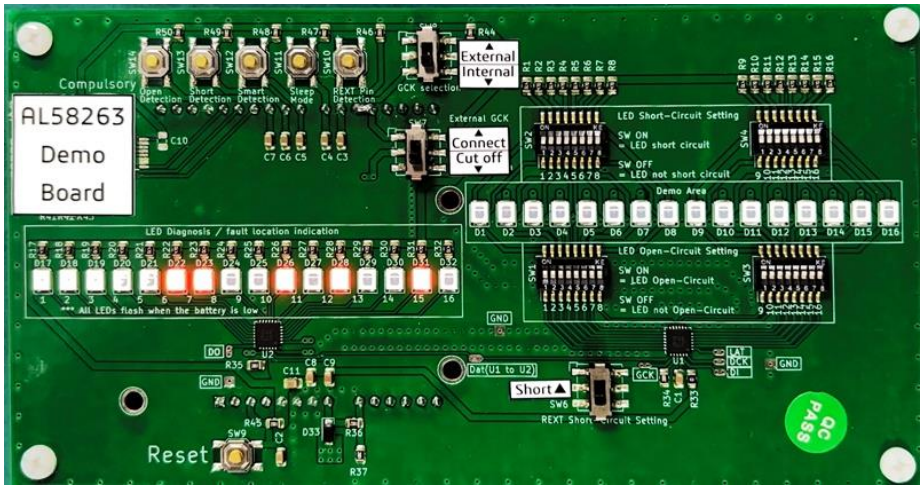

Figure 4. Low Voltage Warning (VIN = 6.5V)

Quick Start Guide

1 Scrolling Mode

1.1 Activate Scrolling Mode by connecting batteries, plugging in the ARDUINO control board to the USB interface for power, or pressing the Reset button.
1.2 Scrolling Mode showcases LEDs (D1~D16) gradually brightening and dimming.

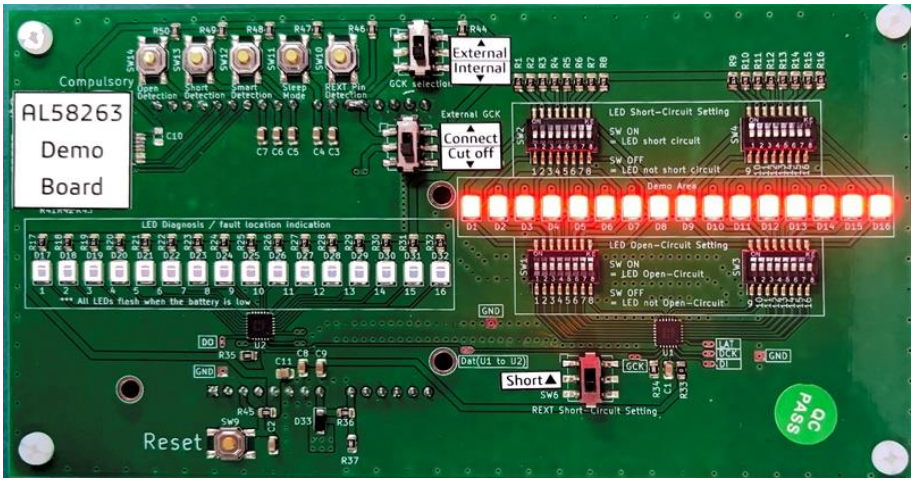

Figure 5. Scrolling Mode

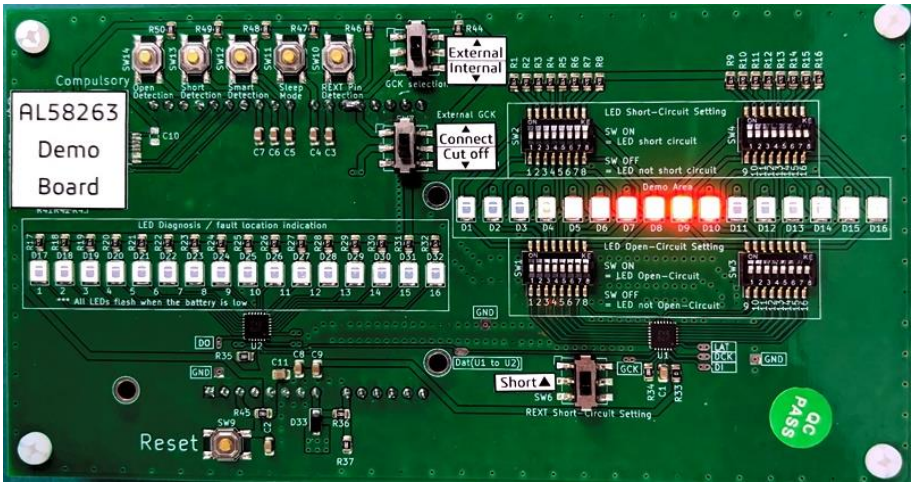

Figure 6. Scrolling Mode

2 LED Open Circuit Detection Mode

2.1 Enter LED Open Circuit Detection Mode during Scrolling Mode by long-pressing SW14 for over 1 second.
2.2 Set a specific LED as an open circuit by toggling the "LED Open Circuit Setting SW1/SW3" to the OFF position, the corresponding LED lights up.
2.3 Press and hold SW14 for more than 1 second returns to Scrolling Mode.

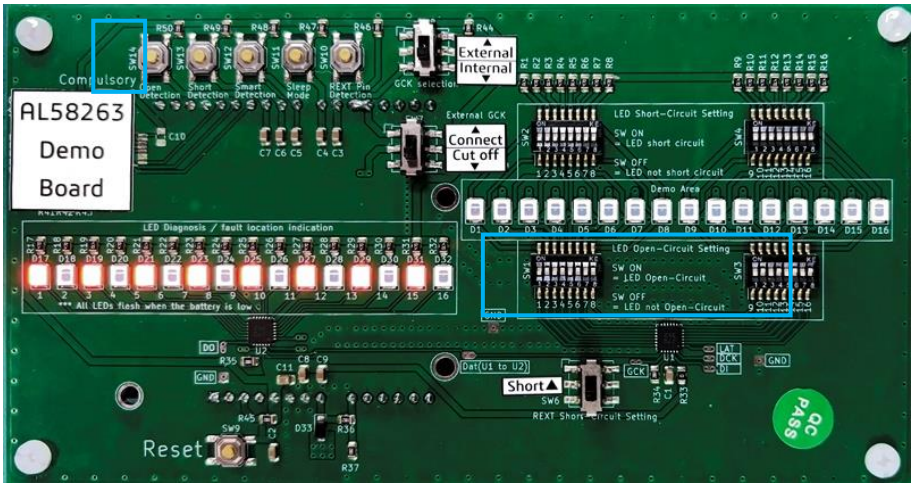

Figure 7. LED Open Circuit Test Mode

3 LED Short Circuit Detection Mode

3.1 Enter LED Short Circuit Detection Mode during Scrolling Mode by long-pressing SW13 for over 1 second.
3.2 Set a specific LED as a short circuit by toggling the "LED short Circuit Setting SW2/SW4" to the ON position, the corresponding LED lights up.
3.3 Press and hold SW13 for more than 1 second returns to Scrolling Mode.

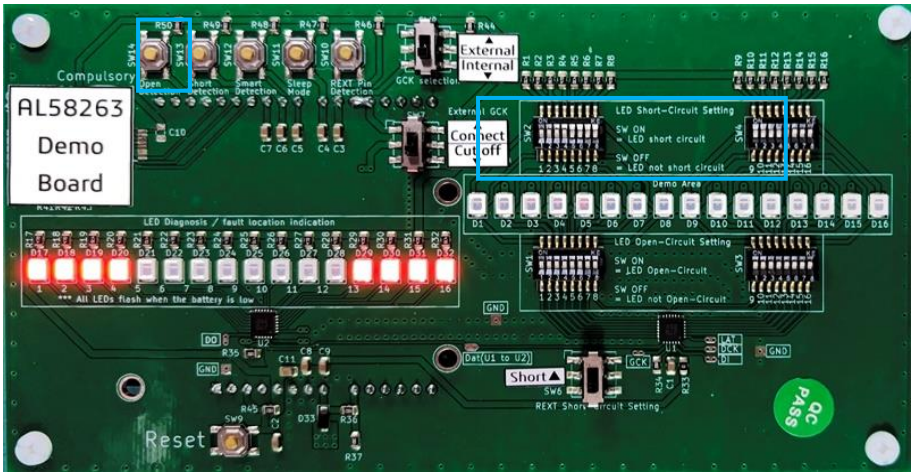

Figure 8. LED Short Circuit Detection Mode

4 LED Smart Detection Mode

4.1 Enter LED Smart Detection Mode during Scrolling Mode by long-pressing SW12 for over 1 second.
4.2 Set a specific LED as an open circuit by toggling the "LED Open Circuit Setting SW1/SW3" to the OFF position or as a short circuit by toggling the "LED short Circuit Setting SW2/ SW4" to the ON position, the corresponding LED lights up.
4.3 Press and hold SW12 for more than 1 second returns to Scrolling Mode.

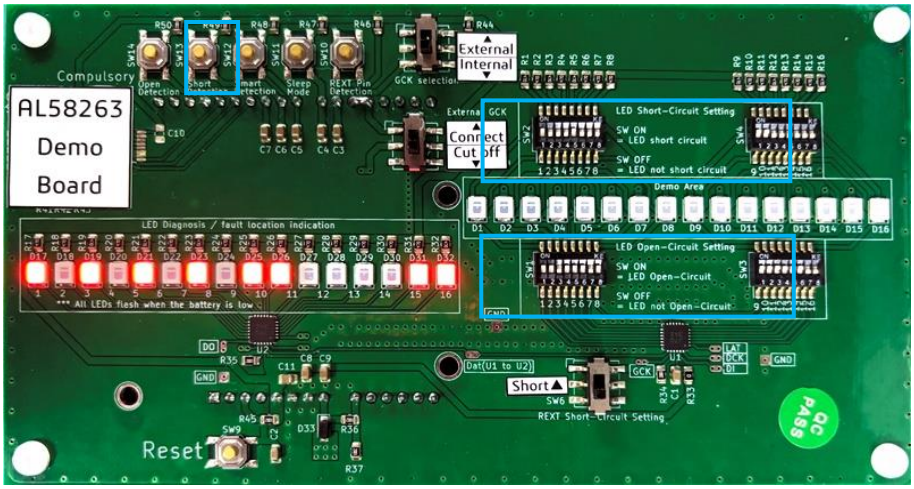

Figure 9. LED Smart Detection Mode

5 Sleep Mode

5.1 Enter Sleep Mode during Scrolling Mode by long-pressing SW11 for over 1 second.
5.2 Press and hold SW11 for more than 1 second returns to Scrolling Mode.

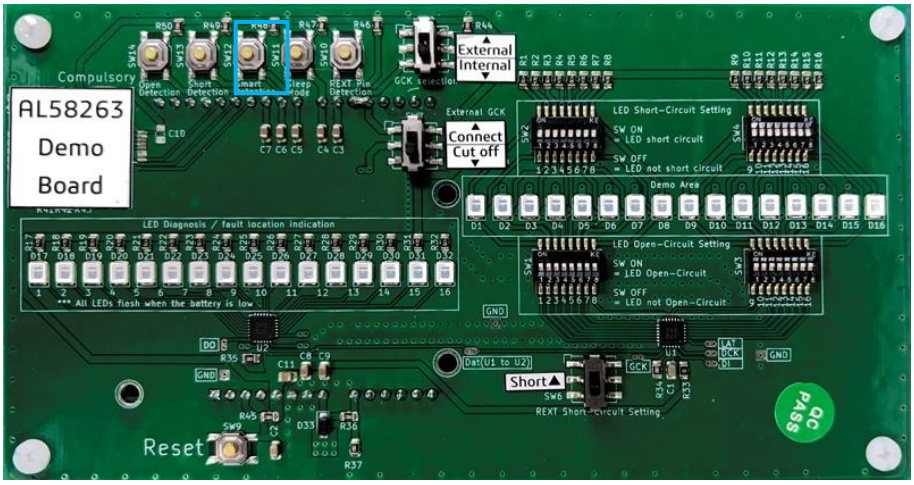

Figure 10. Sleep Mode

6 Rext Short Circuit Detection Mode

6.1 Enter Rext Short Circuit Detection Mode by long-pressing SW10 for over 1 second.
6.2 Toggle the "Rext Short to Ground Setting Switch" to ON to set Rext short to ground.
6.3 When Rext is shorted to ground, LED 1 will flicker at a one-second frequency.
6.4 Press and hold SW10 for more than 1 second returns to Scrolling Mode.

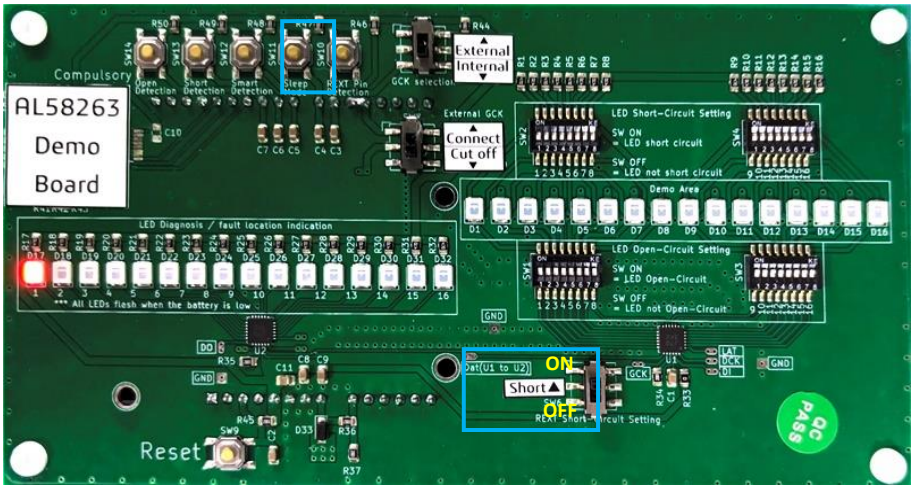

Figure 11. Rext Short Circuit Detection Mode

Evaluation Board Schematic

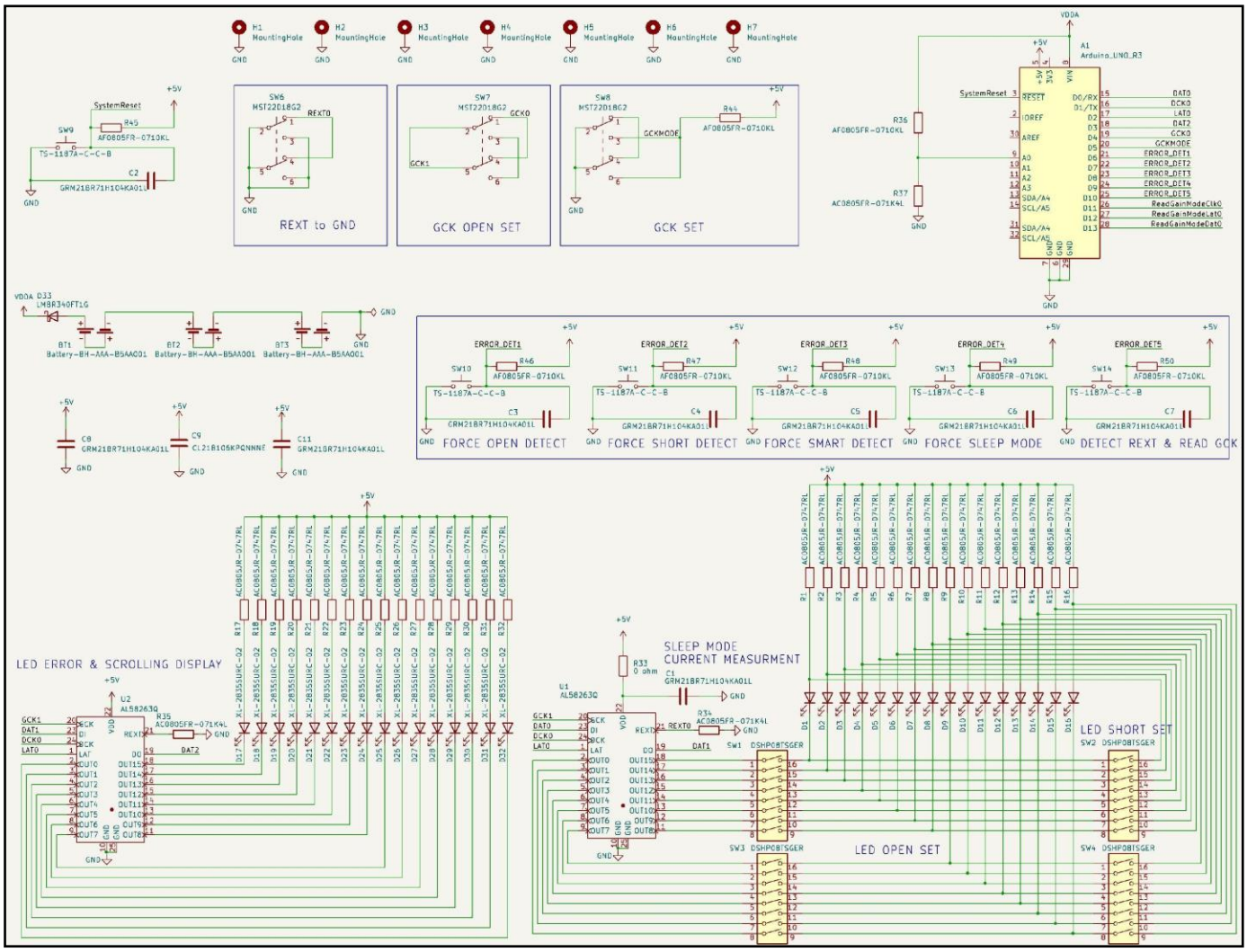

Figure 12. Evaluation Board Schematic

Evaluation Board Layout

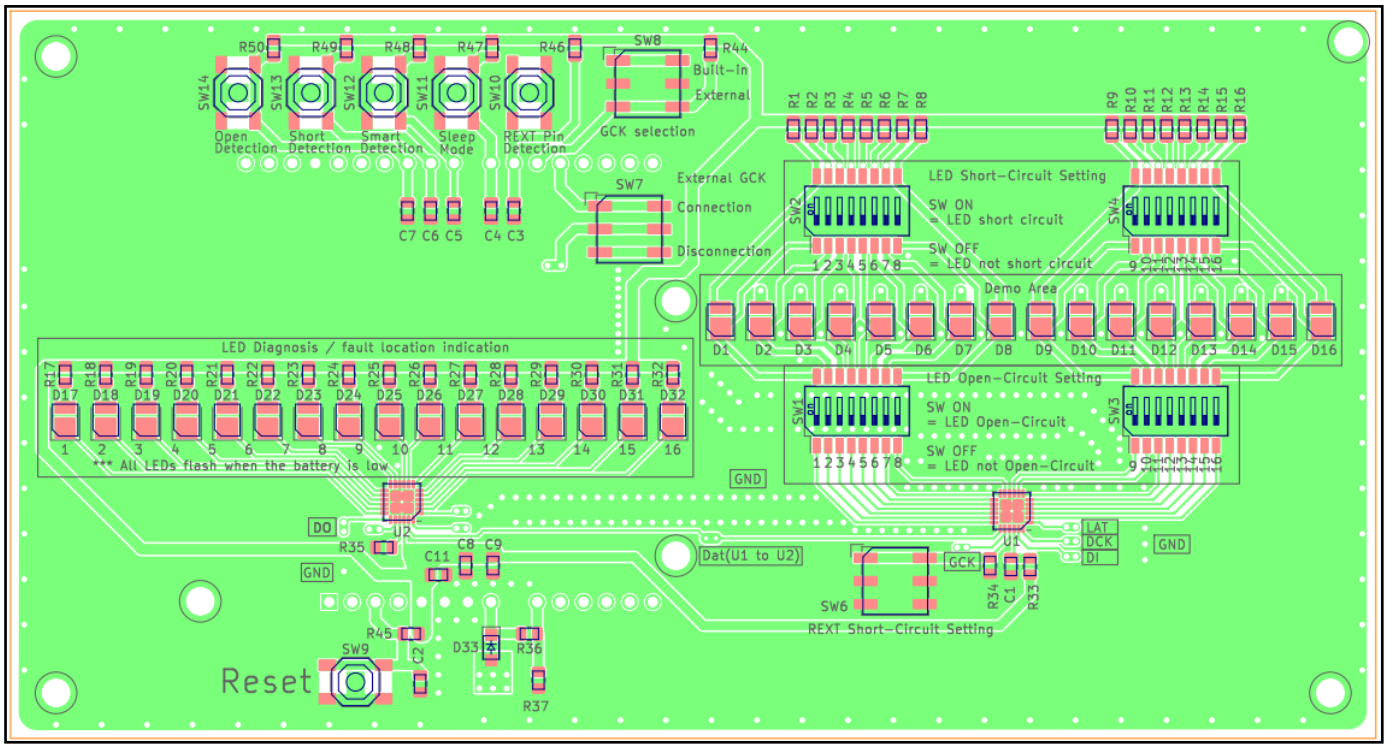

Figure 13. PCB Top Layer View

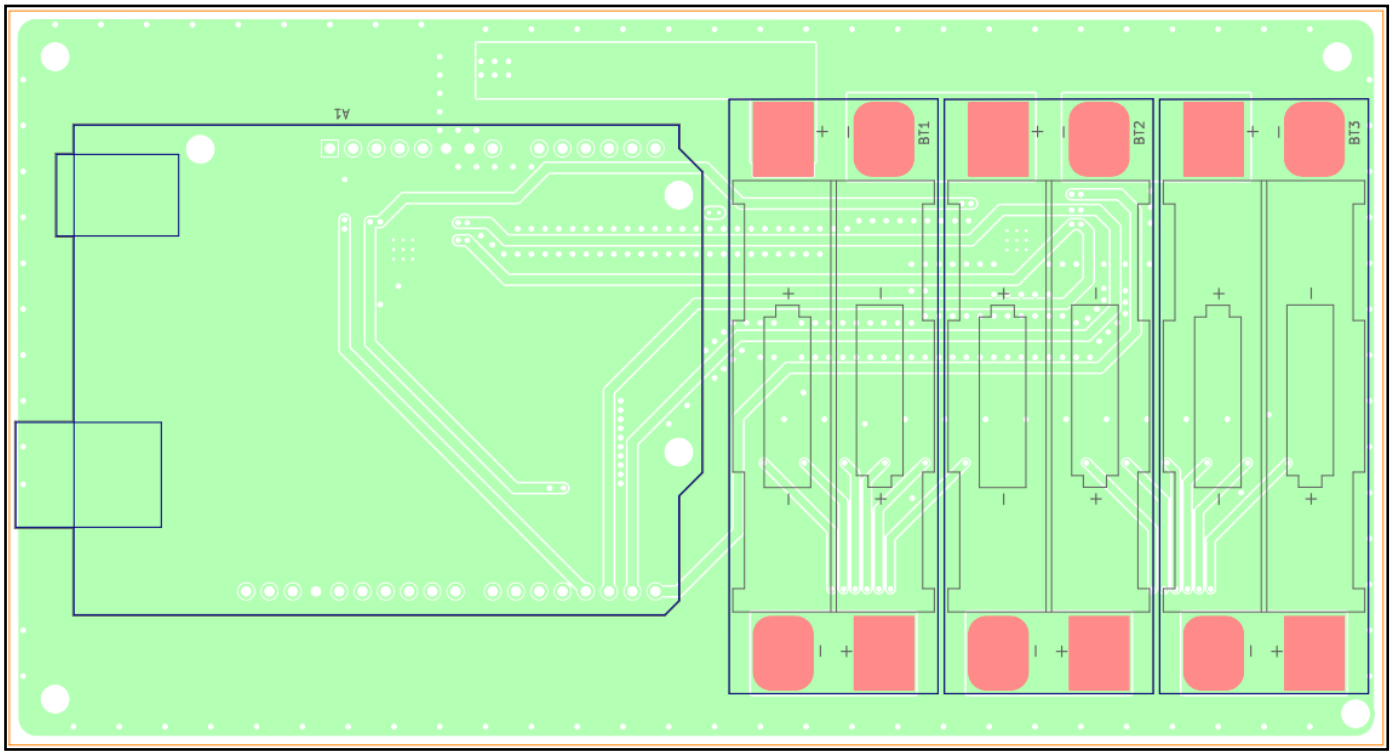

Figure 14. PCB Bottom Layer View

Bill of Materials

Location	Description	Manufacturer	Part Number	Package
U1, U2	16-Channel LED Driver With 16-bit APDM Control	Diodes Incorporated (Diodes)	AL58263Q	TSSOP-24EP
BT1, BT2, BT3	Battery Holder	MYOUNG	BH-AAA-B5AA001	-
C9	Capacitor SMD, 10µF/10V X7R	Samsung Electro-Mechanics	CL21B106KPQNNNE	0805
C1, C2, C3, C4, C5, C6, C7, C8, C11	Capacitor SMD, 0.1µF/50V X7R	Murata	GRM21BR71H104KA01L	0805
D33	Schottky Barrier Rectifiers: 40VDC/IF = 3A	Diodes	B340AQ	SMA
D1 ~ D32	Red LED SMD, Forward Current = 40mA	XINGLIGHT	XL-2835SURC-02	SMD2835
R33	Resistor SMD, 0Ω 1%, 1/8 W	YAGEO	AC0805FR-070RL	0805
R34, R35, R37	Resistor SMD, 2kΩ 1%, 1/8 W	YAGEO	AC0805FR-072KL	0805
R1~R32	Resistor SMD, 47Ω 1%, 1/8 W	YAGEO	AC0805JR-0747RL	0805
R36, R38~R50	Resistor SMD, 10kΩ 1%, 1/8 W	YAGEO	AF0805FR-0710KL	0805
SW1~SW4	Button Switch	KINGTEK	DSHP08TSGER	DIP-8
SW5	Button Switch	KINGTEK	DSHP06TS-S	DIP-6
SW6~SW8	Button Switch, SMD, SW_SPST_SKQG	SHOU HAN	MST22D18G2	SMD 3.6 x 9.1
SW9~SW14	Button Switch	XKB Connection	TS-1187A-C-C-B	DIP-6

System Performance

1. Global Current Control（VDD = 5.5V）

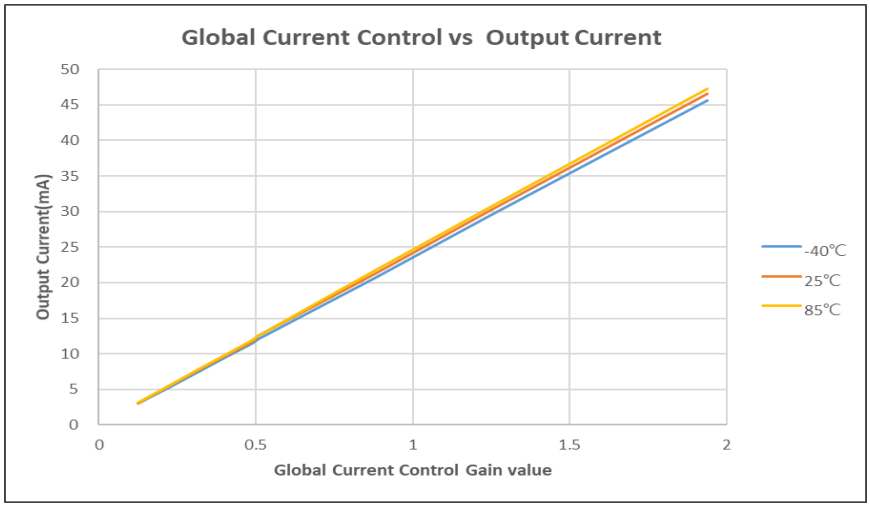

Figure 15. Global Current Control vs. Output Current

2. Turn ON/OFF Waveform

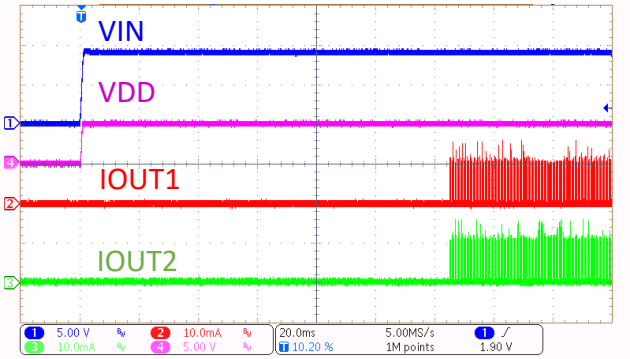

Figure 16. Turn ON Waveform

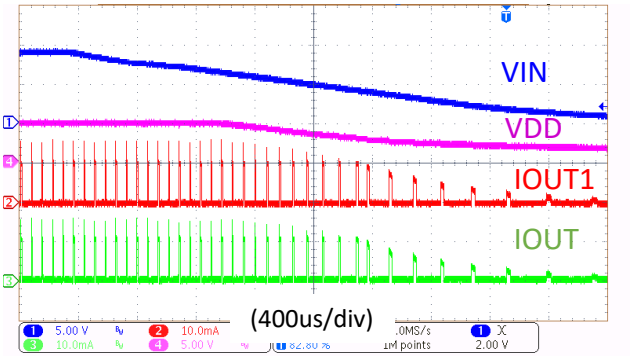

Figure 17. Turn OFF Waveform

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

www.diodes.com