

General Description

The AL58263 is a 16-channel constant-current LED driver with 16-bit grayscale Adaptive Pulse Density Modulation (APDM) and supports error diagnostics, power-saving functionality, 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 efficiently separating the frame waveform.

The device operates over a 3.3V to 5V input voltage range ($\pm 10\%$), fast 30MHz DCK input, and provides 16 open-drain constant-current sinking outputs that are rated to 15V and deliver up to 55mA of high-accuracy current to each LED string. The current at each output is programmable by an external current-sensing resistor and can be adjusted by a 6-bit global current control.

The AL58263 also supports compulsory error detection, where the display image will not be affected as the intervals and currents are small. Differing from error mode selections; the specified diagnostic can be performed. Errors will be stored in the shift register and can be read out from the DO pin. Moreover, the threshold voltage for LED short detection can be selected to comply with different LED string configurations. Sleep mode can also efficiently lower the supply current in power-saving applications.

The AL58263 is available in the TSSOP-24EP package and is specified over the -40°C to $+85^{\circ}\text{C}$ ambient temperature range.

Applications

- Indoor and outdoor LED video displays
- Variable message signs (VMS)
- Dot matrix modules
- LCD display backlighting

Key Features

- 3.3~5V operating supply voltage ($\pm 10\%$)
- 2~55mA/5V, 2~35mA/3.3V output current range
- 15V rated output channels for long LED strings
- $\pm 1.5\%$ (typ.) LED current accuracy between channels
- $\pm 3\%$ (typ.) LED current accuracy between chips
- $\pm 0.1\%$ output current regulation capability
- 16-bit grayscale resolution with Adaptive Pulse Density Modulation (APDM) control
- Non-scramble waveform for high-power LED applications
- Grayscale counter reset selection
- Grayscale data synchronization selection
- 6-bit global current control: from 12.5% to 200%
- Compulsory error detection includes LED open, LED short output port leakage, output short-to-GND, output short-to-power, and REXT short-to-GND
- Compulsory error detection with 0.1mA
- Short detection threshold voltage selection (2/3/4/4.5V)
- Sleep mode to lower the supply current to 10 μA (typ.)
- Overtemperature warning
- 30MHz Clock frequency for data transfer
- EMI reduction grayscale clock
- External GCK watchdog
- 8KV ESD protection on current output pins
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **An automotive-compliant part is available under a separate datasheet ([AL58263Q](#)).**

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain $<900\text{ppm}$ bromine, $<900\text{ppm}$ chlorine ($<1500\text{ppm}$ total Br + Cl) and $<1000\text{ppm}$ antimony compounds.

Hardware Description

The AL58263EV1 evaluation board is shown in Figure 1 and Figure 2.

Figure 1: Top View

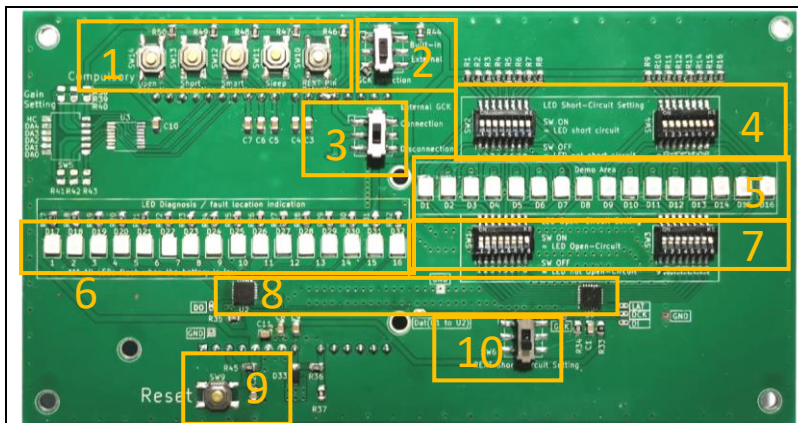
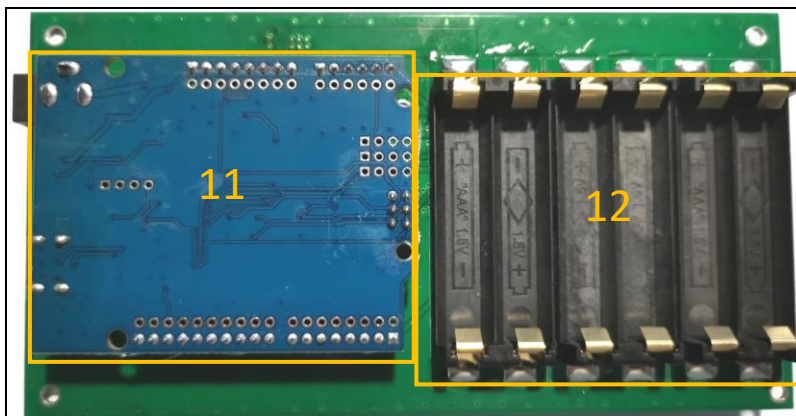


Figure 2: Bottom View



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 digits 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)

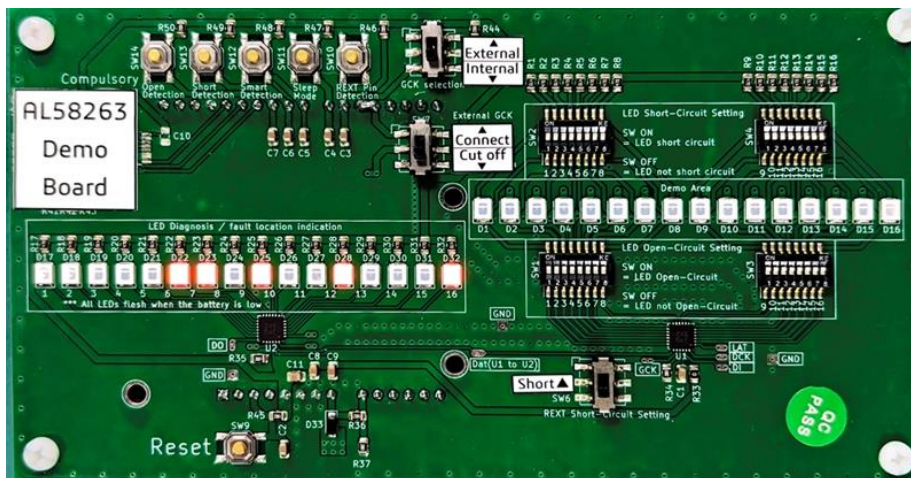
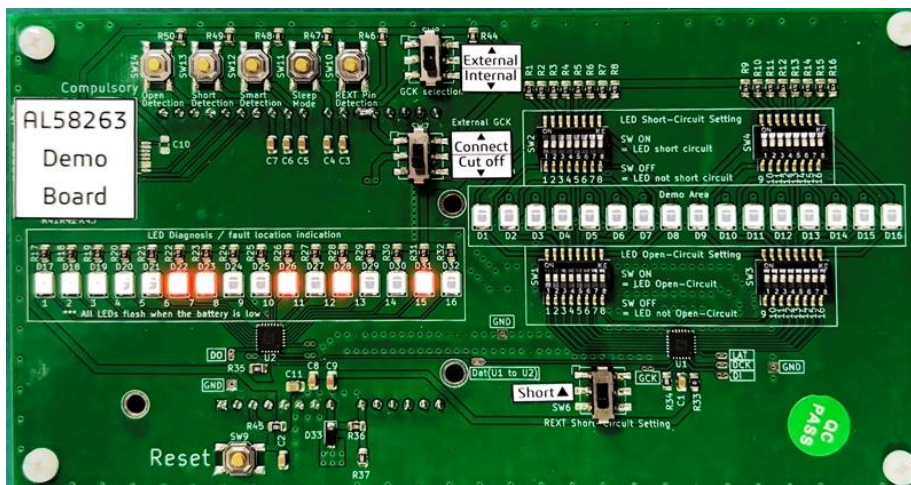


Figure 4: Low Voltage Warning (VIN=6.5V)



Quick Start Guide

Scrolling Mode

1. Activate Scrolling Mode by connecting the batteries, plugging in the ARDUINO control board to the USB interface for power, or pressing the Reset button.
2. Scrolling Mode showcases LEDs (D1~D16) gradually brightening and dimming in the "Demo Area" LED section.

Figure 5: Scrolling Mode

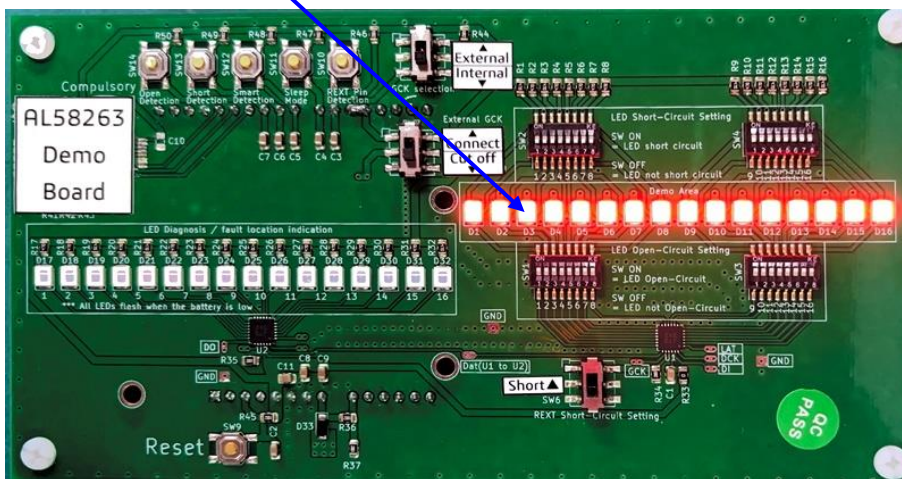
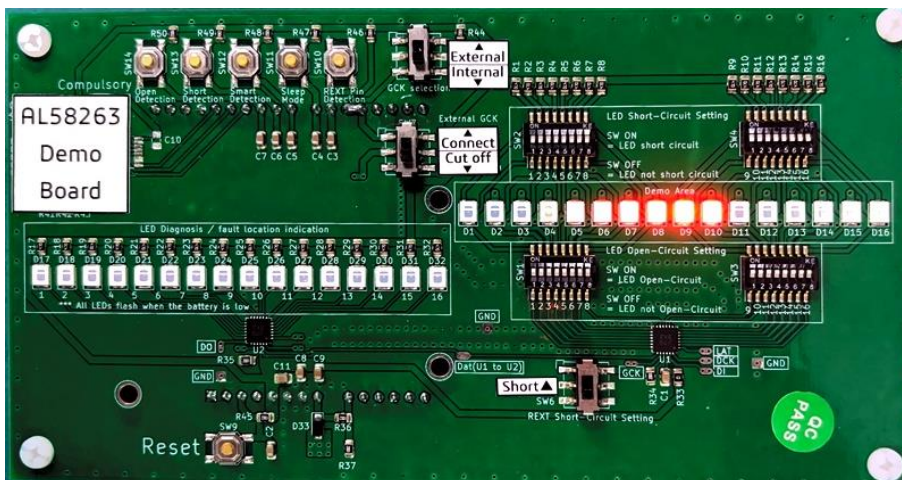


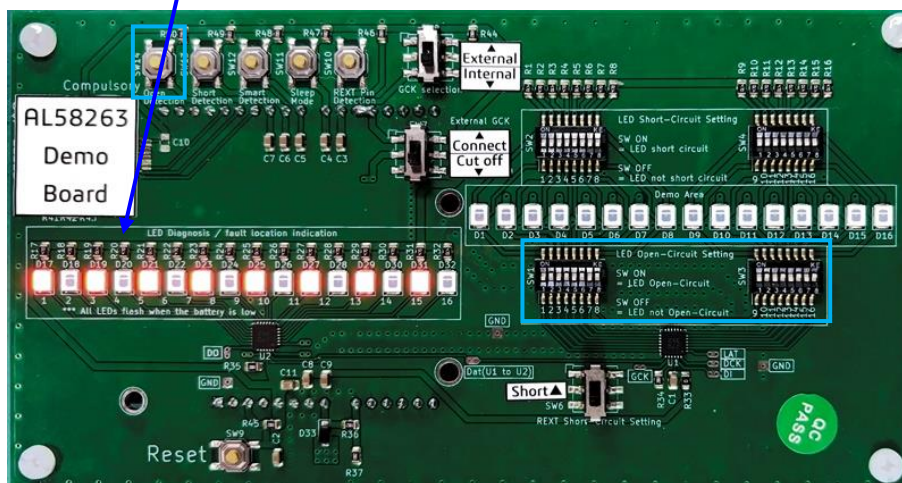
Figure 6: Scrolling Mode



LED Open-Circuit Detection Mode

1. Enter LED Open Circuit Detection Mode during Scrolling Mode by long-pressing SW14 for over 1 second.
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 in the "LED Diagnosis / Fault Location Indication" LED section
3. Press and hold SW14 for more than 1 second to return to Scrolling Mode.

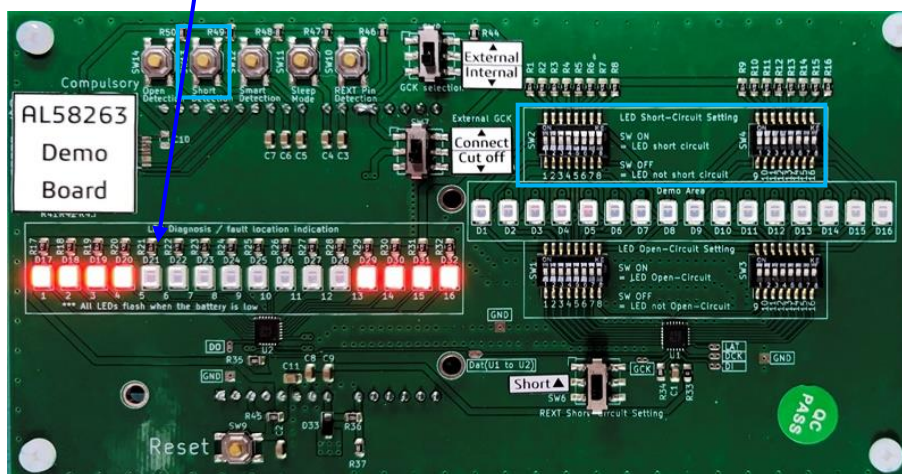
Figure 7: LED Open-Circuit Test Mode



LED Short-Circuit Detection Mode

1. Enter LED Short Circuit Detection Mode during Scrolling Mode by long-pressing SW13 for over 1 second.
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 in the "LED Diagnosis / Fault Location Indication" LED section.
3. Press and hold SW13 for more than 1 second to return to Scrolling Mode.

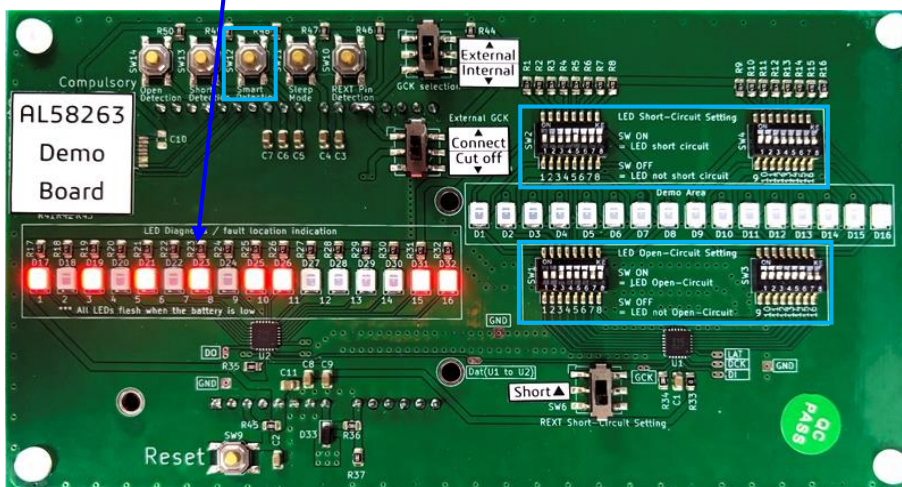
Figure 8: LED Short-Circuit Detection Mode



LED Smart Detection Mode

1. Enter LED Smart Detection Mode during Scrolling Mode by long-pressing SW12 for over 1 second.
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 in the "LED Diagnosis / Fault Location Indication" LED section.
3. Press and hold SW12 for more than 1 second to return to Scrolling Mode.

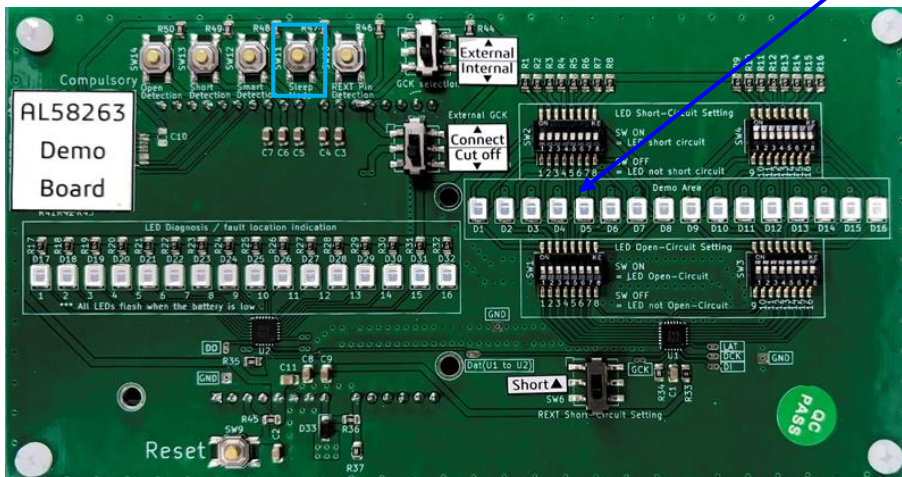
Figure 9: LED Smart Detection Mode



Sleep Mode

1. Enter Sleep Mode during Scrolling Mode by long-pressing SW11 for over 1 second. All 16 LEDs turn off in the "Demo Area".
2. Press and hold SW11 for more than 1 second to return to Scrolling Mode.

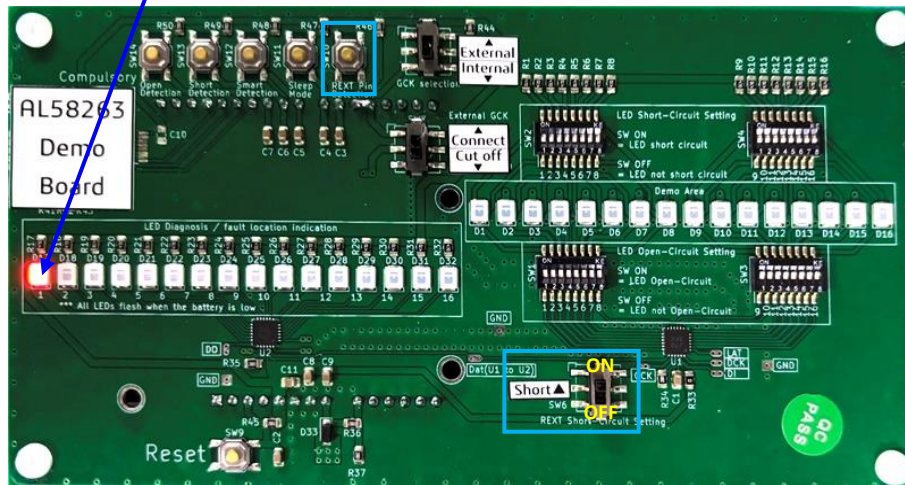
Figure 10: Sleep Mode



Rext Short-Circuit Detection Mode

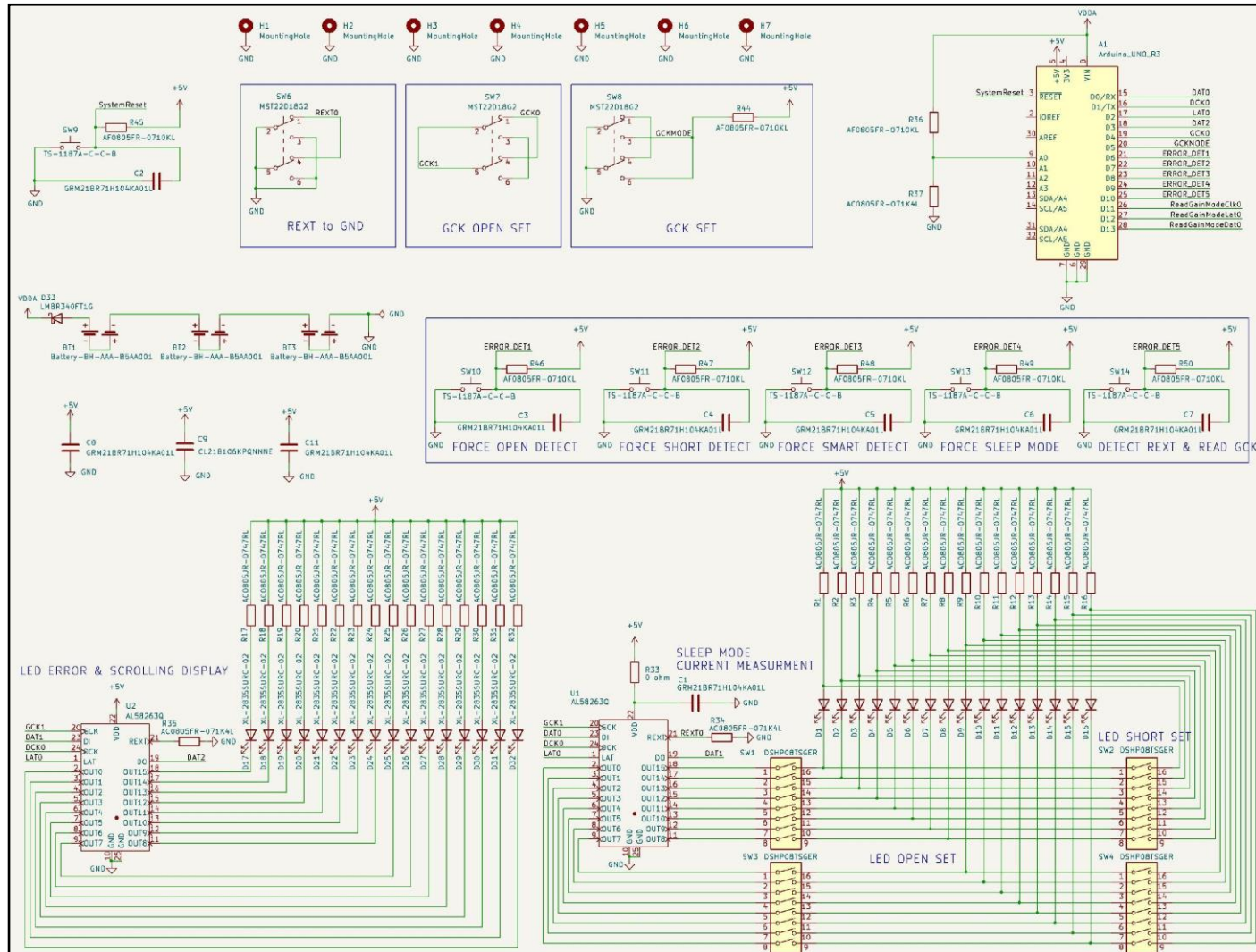
1. Enter Rext Short Circuit Detection Mode by long-pressing SW10 for over 1 second.
2. Toggle the "Rext Short to Ground Setting Switch" to ON to set Rext short to ground.
3. When Rext is shorted to ground, LED 1 will flicker at a one-second frequency in the "LED Diagnosis / Fault Location Indication" LED section.
4. Press and hold SW10 for more than 1 second to return to Scrolling Mode.

Figure 11: Rext Short Circuit Detection Mode



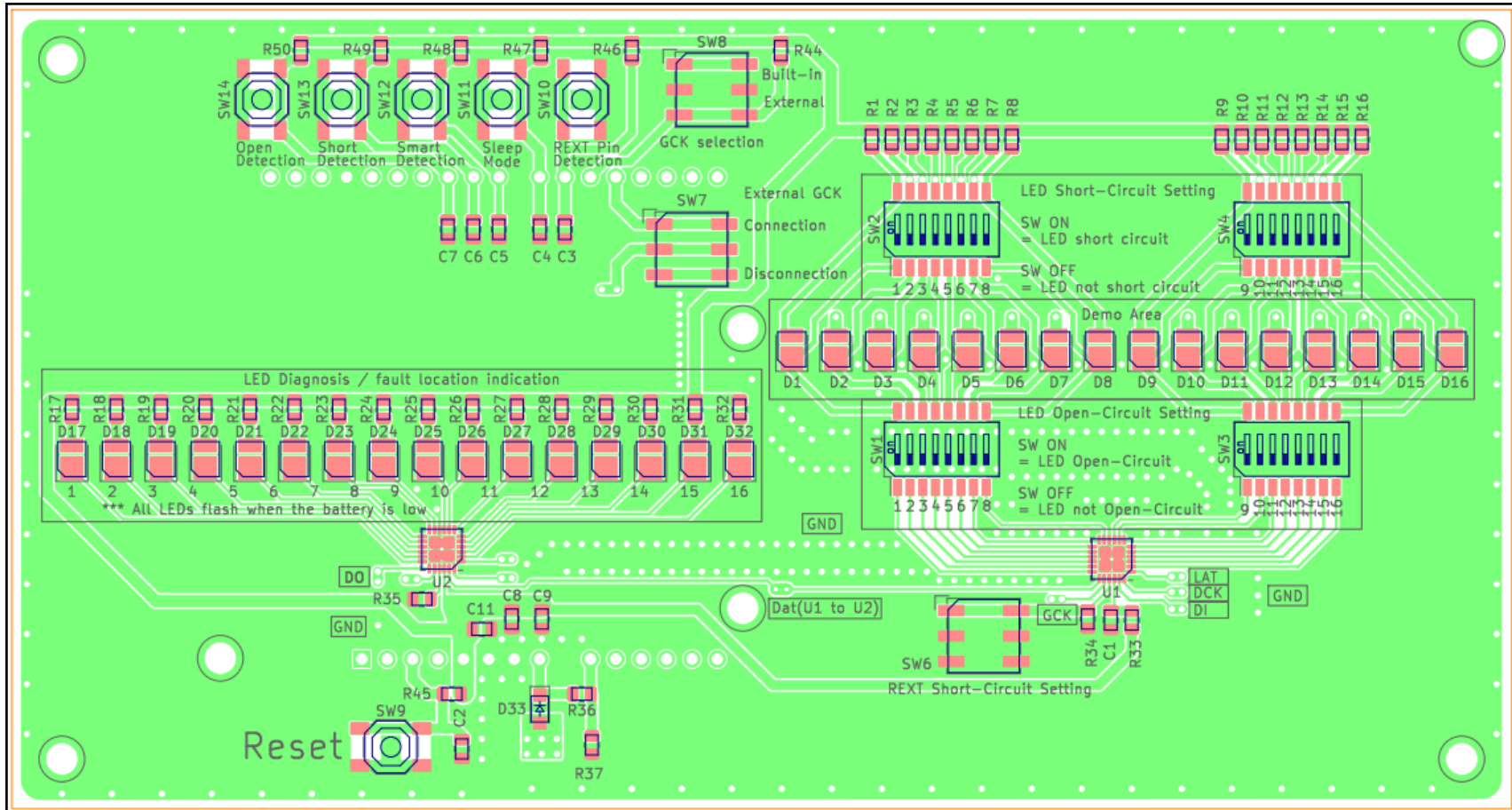
Evaluation Board Schematic

Figure 12: Evaluation Board Schematic



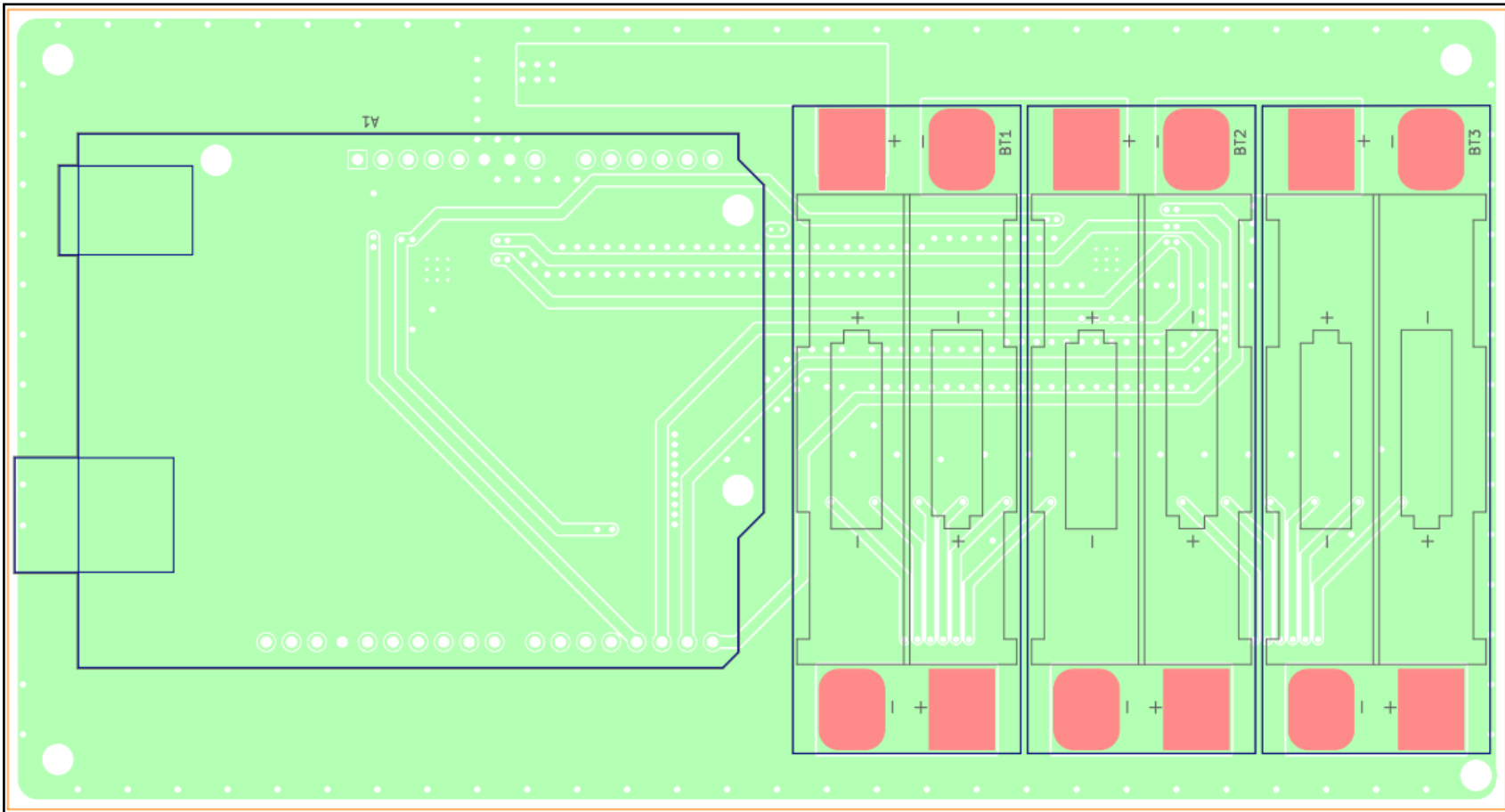
Evaluation Board Layout

Figure 13: PCB Top Layer View



Evaluation Board Layout (continued)

Figure 14: PCB Bottom Layer View



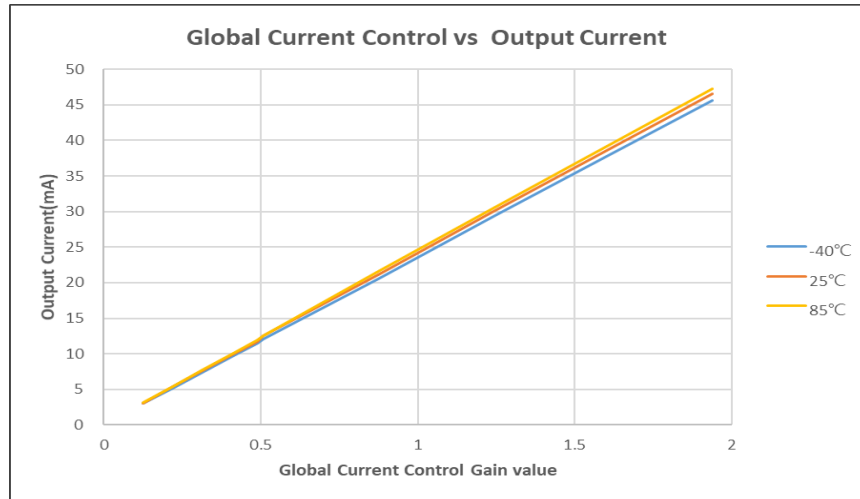
Bill of Materials

Ref.	Description	Manufacturer	Part Number	Package
U1, U2	16-Channel LED Driver with 16-Bit APDM Control	Diodes Incorporated	AL58263Q	TSSOP-24EP
BT1, BT2, BT3	Battery Holder	MYOUNG	BH-AAA-B5AA001	-
C9	Capacitor SMD, 10uF/10V X7R	Samsung Electro-Mechanics	CL21B106KPQNNNE	0805
C1, C2, C3, C4, C5, C6, C7, C8, C11	Capacitor SMD, 0.1uF/50V X7R	Murata	GRM21BR71H104KA01L	0805
D33	Schottky Barrier Rectifiers:40VDC/IF=3A	Diodes Incorporated	B340AQ	SMA
D1 ~ D32	Red LED SMD, Forward Current=40mA	XINGLIGHT	XL-2835SURC-02	SMD2835
R33	Resistor SMD, 0 ohm 1 %, 1/8 W	YAGEO	AC0805FR-070RL	0805
R34, R35, R37	Resistor SMD, 2k ohm 1 %, 1/8 W	YAGEO	AC0805FR-072KL	0805
R1~R32	Resistor SMD, 47 ohm 1 %, 1/8 W	YAGEO	AC0805JR-0747RL	0805
R36, R38~R50	Resistor SMD, 10k ohm 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 3.6x9.1
SW9~SW14	Button Switch	XKB Connection	TS-1187A-C-C-B	DIP-6

System Performance

- Global Current Control (VDD=5.5V)

Figure 15: Global Current Control vs Output Current



- Turn ON/OFF Waveform

Figure 16: Turn ON waveform

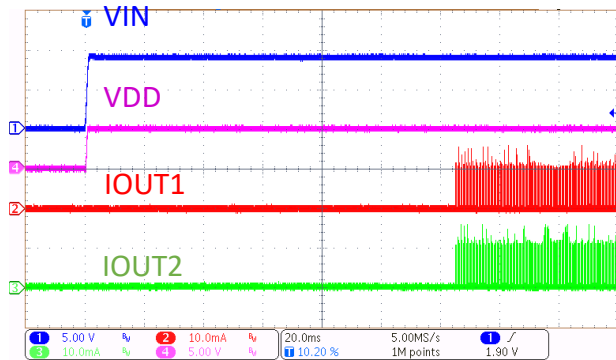
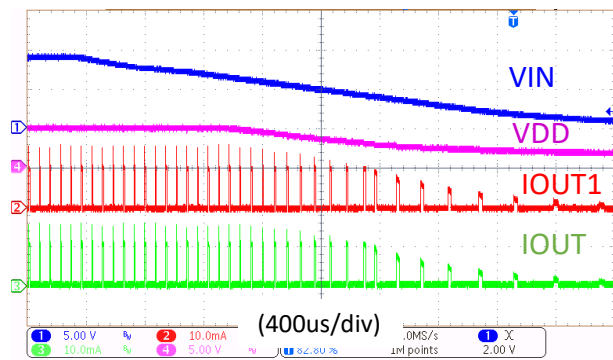


Figure 17: Turn OFF waveform



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