General Description

The AL58263Q 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 (±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 AL58263Q 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 AL58263Q is available in the Wettable Flank W-QFN4040-24/SWP (Type A1) package and specified over the -40°C to +125°C ambient temperature range.

Automotive Applications

- Clusters
- Local dimming displays
- Front and back faceplates
- Center stack displays
- Interior and RGB lightings
- HVAC control panels
- Gear shifter indicators
- Exterior lightings

Specifications

Parameter	Value
Input Voltage	USB-C
Output Current	6.725mA
Output Voltage	5V
Dimension	150mm*80mm*20mm
RoHS Compliance	Yes

Features

- AEC-Q100 Grade 1
- Input Voltage VDD: 3V to 5.0V
- Output Current Range
  - 2 to 55mA/5.0V
  - ±0.1% (typ) Output Current Regulation
- 16 Constant-Current Sink Output Channel
  - 16-Bit Grayscale Resolution
    - 6-Bit Global Current Control
    - 15V Rated Output Channels
    - ±1.5% (typ) LED Current Accuracy Between Channels
    - ±3% (typ) LED Current Accuracy Between Chips
    - Stagger Outputs Delay for EMI Reduction
    - Cascaded Capability (max 1,440 Devices)
  - Detection and Diagnosis
    - Error Detection Includes LED Open, LED Short, Output Port Leakage, Output Short-to-GND, Output Short-to-Power and REXT Short-to-GND
    - Pre-Overtemperature Warning
  - 4-Wire Serial Interface +1 (LAT, DI, DO, DCK + GCK)
    - 25MHz Data Clock (DCK) Frequency for Data Transfer
    - Double Edge Gray Scale Clock up to 16MHZ (GCK)
    - External GCK Watchdog Timer
    - Zero Data and Sleep Mode for Power Saving
  - Register Programmable Options
    - Regular PWM or Adaptive Pulse Density Modulation
    - Built Internal PWM or External Gray Scale Clock (GCK)
    - Short Detection Threshold Voltage Selection (2/3/4/4.5V)

- **Totally Lead-Free & Fully RoHS Compliant**
- **Halogen and Antimony Free. "Green" Device**
- **The AL58263Q 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/**

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Hardware Description

The AL58263Q evaluation board as shown in Figure 1 and Figure 2:

SW9：REXT pin detection
SW10：Sleep mode
SW11：Smart detection
SW12：Short detection
SW13：Open Detection

SW1、3：Open LED
SW2、4：Short LED

SW6：GCK selection
SW7：External GCK

SW14：GCC Setting

SW8：Reset

SW5：REXT short to GND
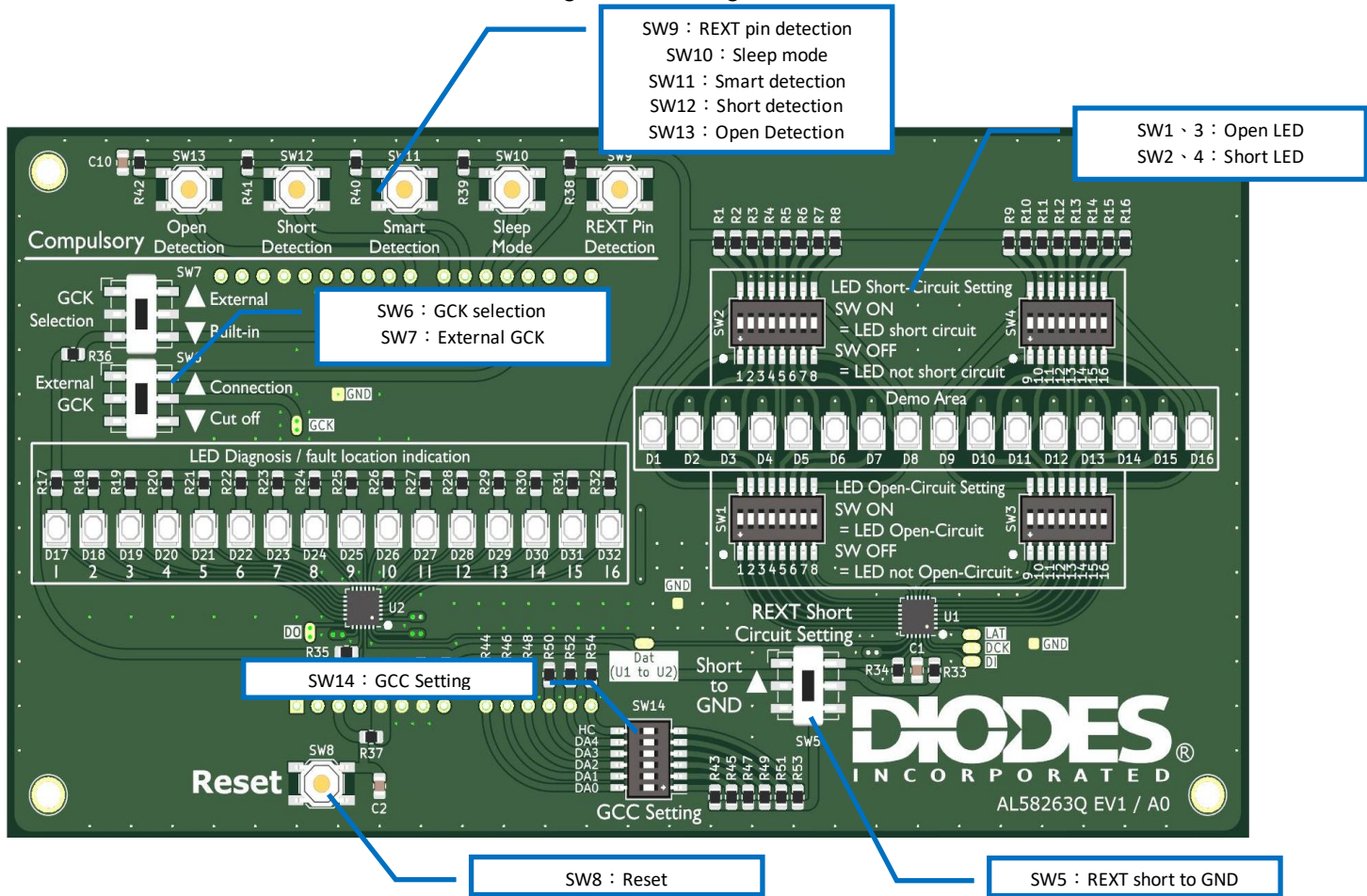
Figure 1. Top View

Symbol	Description
SW1	To simulate an LED open condition, disconnect the LED in the circuit.
SW2	To simulate an LED short condition, short the LED in the circuit.
SW3	To simulate an LED open condition, disconnect the LED in the circuit.
SW4	To simulate an LED short condition, short the LED in the circuit.
SW5	To simulate REXT short to GND condition, short the REXT pin to GND in the circuit.
SW6	GCK selection , connection or disconnection of external GCK
SW7	GCK internal/external select switch
SW8	System Reset button
SW9	Detection and Diagnosis：REXT pin
SW10	Enable Sleep mode
SW11	Detection and Diagnosis：Smart detection
SW12	Detection and Diagnosis：Short detection
SW13	Detection and Diagnosis：Open detection
SW14	GCC Setting：adjust the output current by 64 steps.

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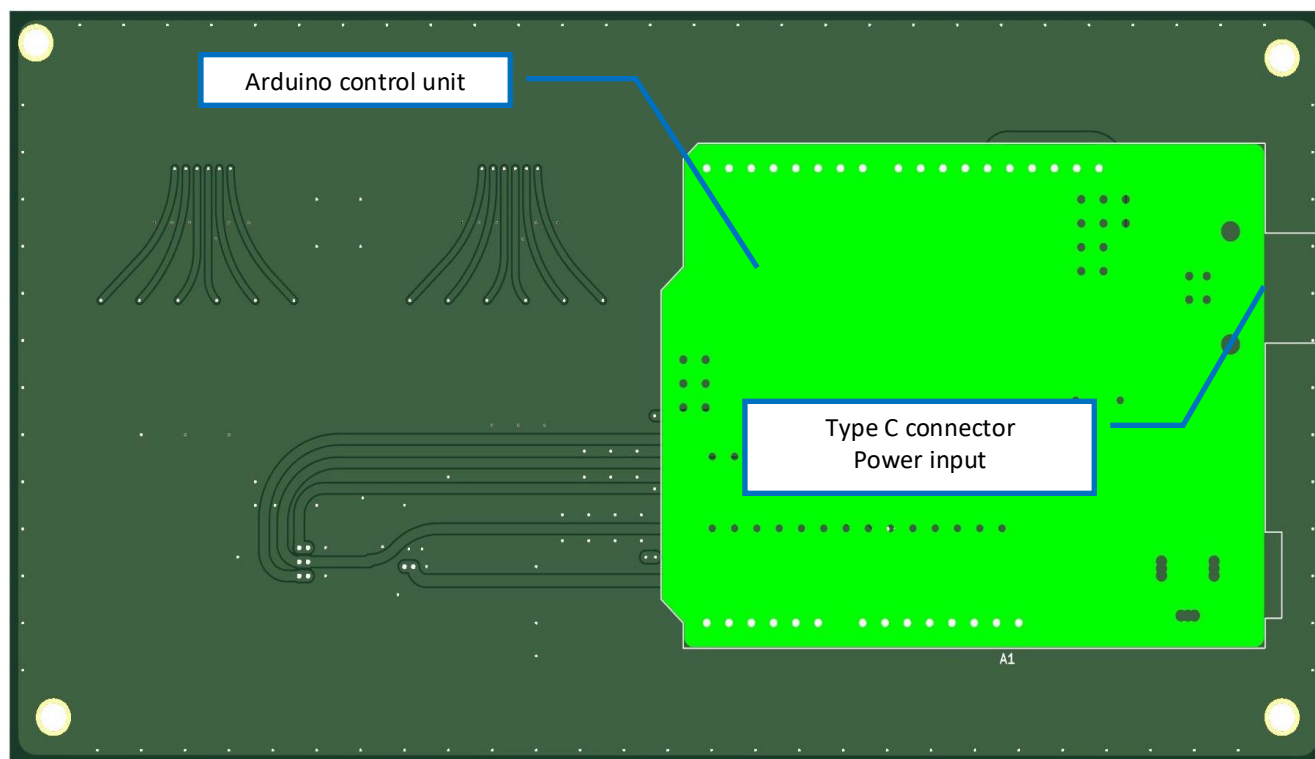© 2024 Copyright Diodes Incorporated. All Rights Reserved.

Figure 2. Bottom View

Power Supply Options

Connecting the ARDUINO control board via the USB interface (type C) to serve as the power source.

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.

2 LED Open Circuit Detection Mode

2.1 Enter LED Open Circuit Detection Mode during Scrolling Mode by long-pressing SW13 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.

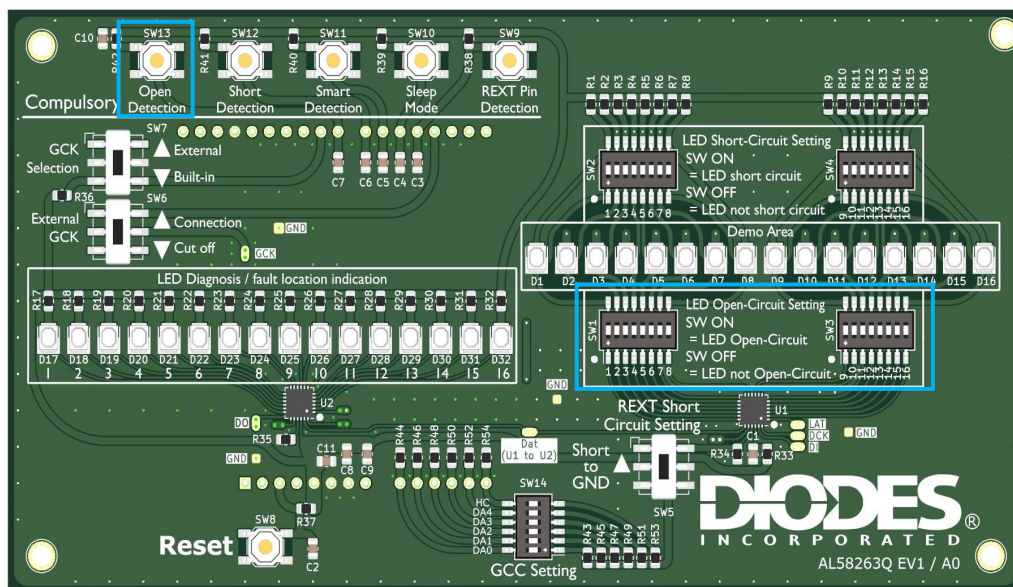2.3 Press and hold SW13 for more than 1 second returns to Scrolling Mode.

Figure 3. 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 SW12 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 SW12 for more than 1 second returns to Scrolling Mode.
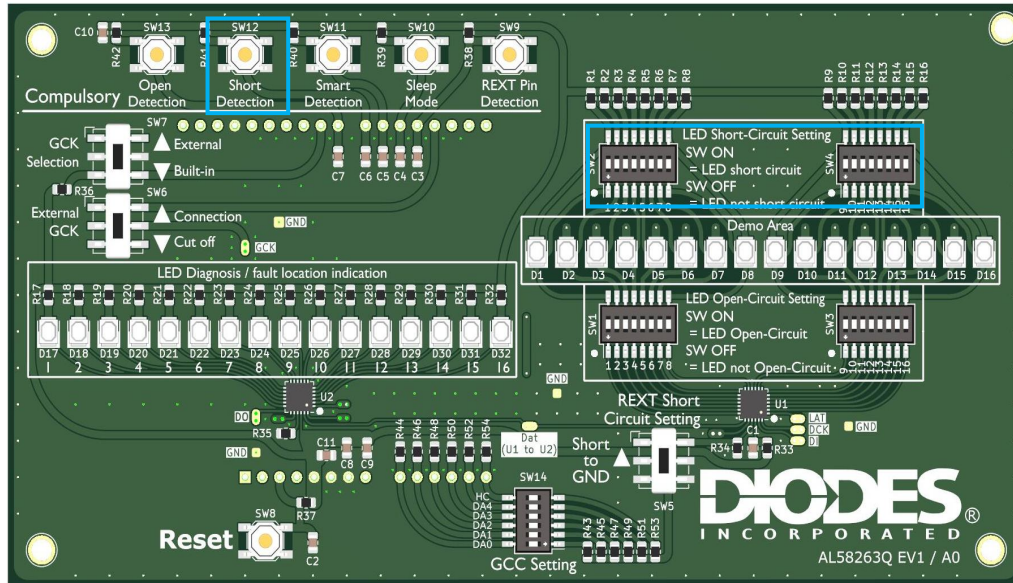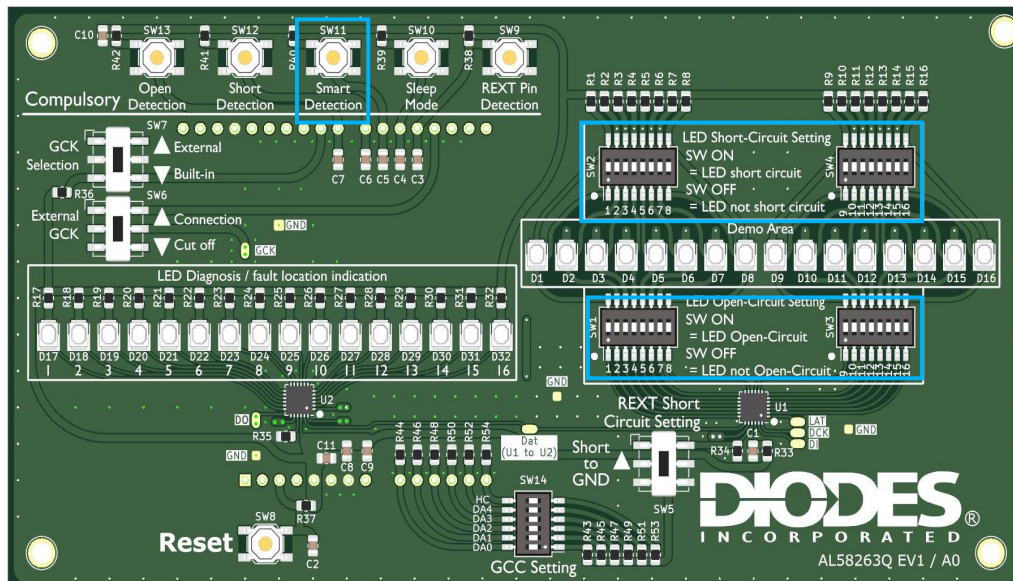
Figure 4. LED Short Circuit Detection Mode

4   LED Smart Detection Mode

4.1   Enter LED Smart Detection Mode during Scrolling Mode by long-pressing SW11 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 SW11 for more than 1 second returns to Scrolling Mode.

Figure 5. LED Smart Detection Mode

5   Sleep Mode

5.1   Enter Sleep Mode during Scrolling Mode by long-pressing SW10 for over 1 second.

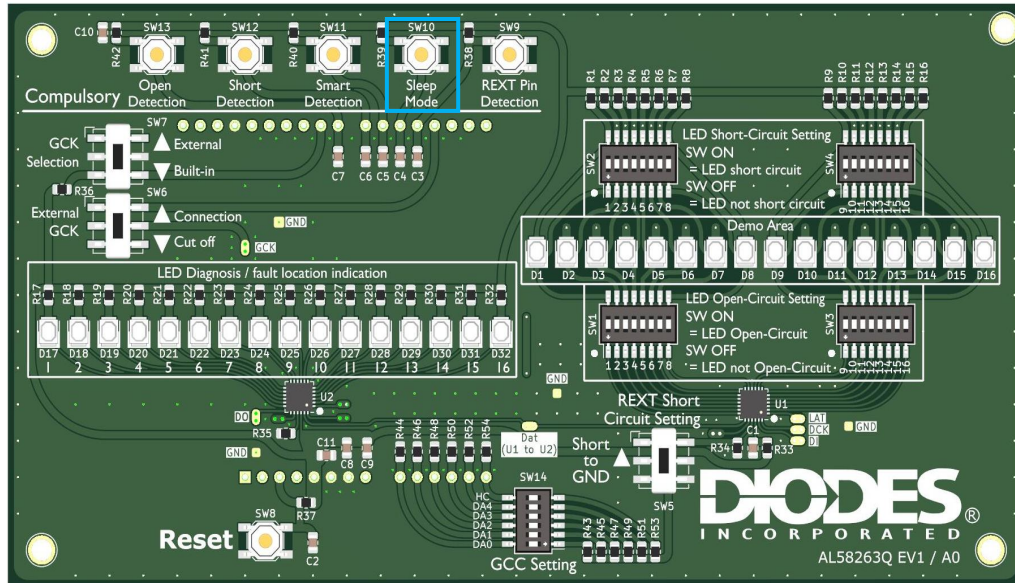5.2   Press and hold SW10 for more than 1 second returns to Scrolling Mode.

Figure 6. Sleep Mode

6 Rext Short Circuit Detection Mode

6.1 Enter Rext Short Circuit Detection Mode by long-pressing SW9 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.

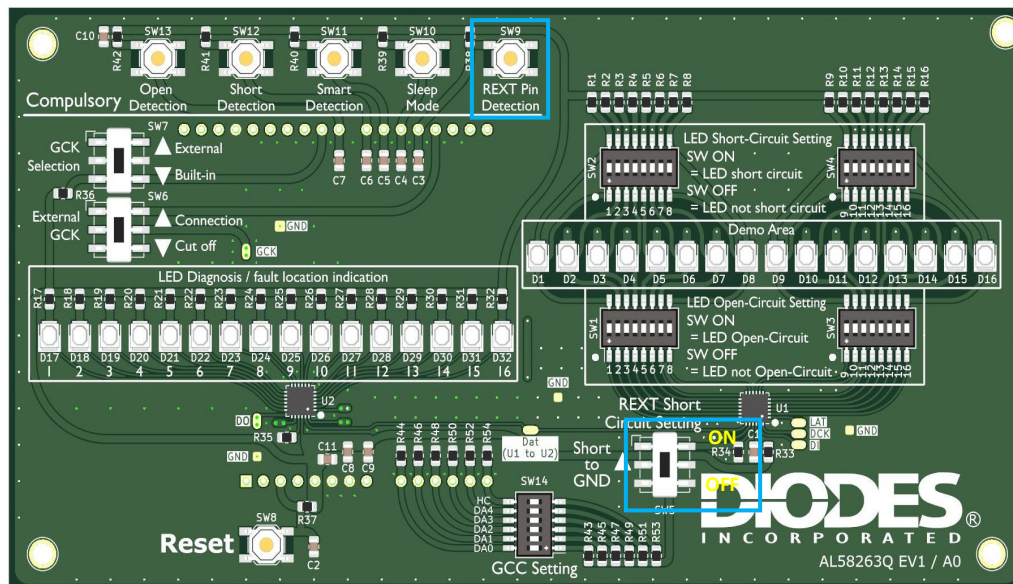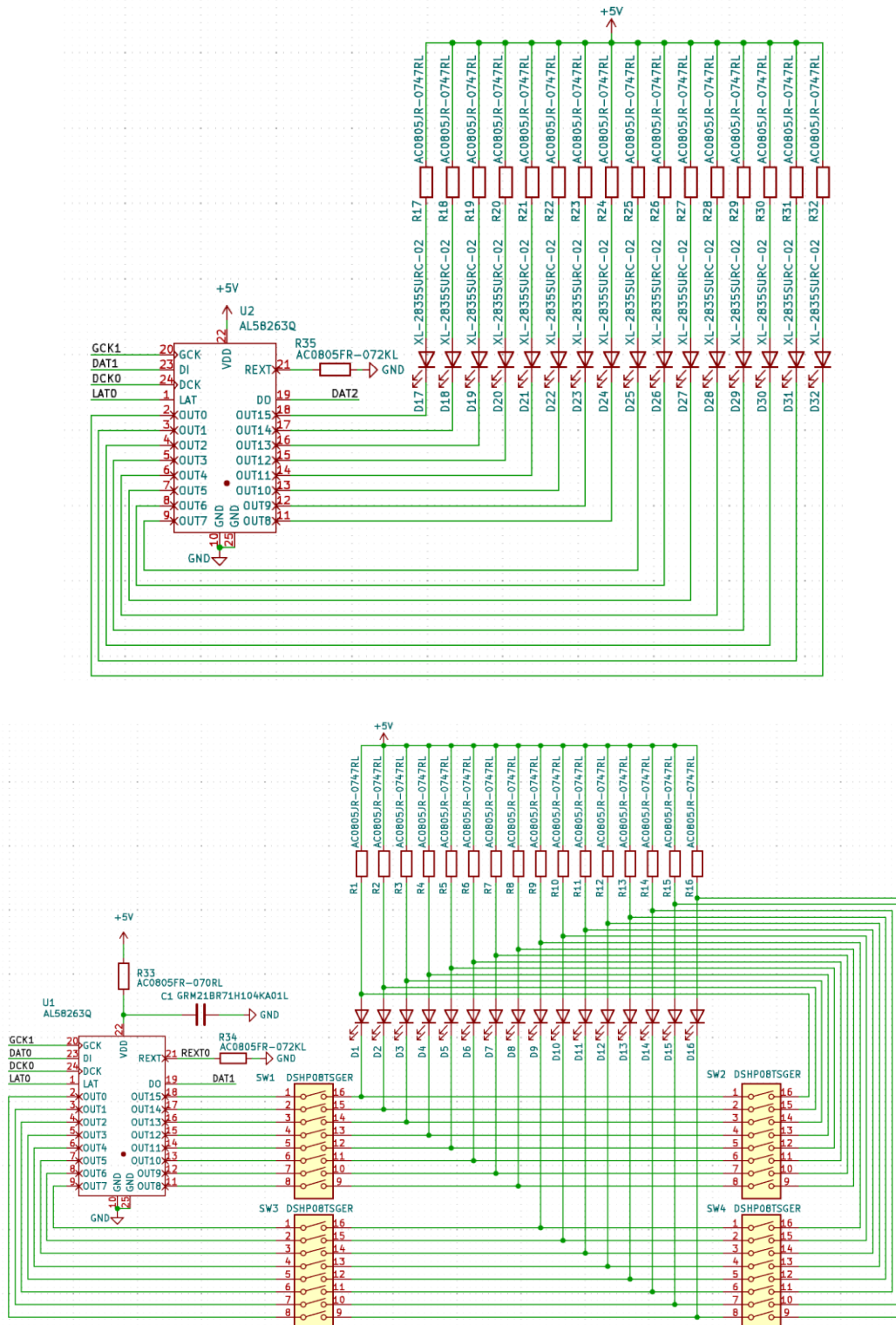6.4 Press and hold SW9 for more than 1 second returns to Scrolling Mode.

Figure 7. Rext Short Circuit Detection Mode
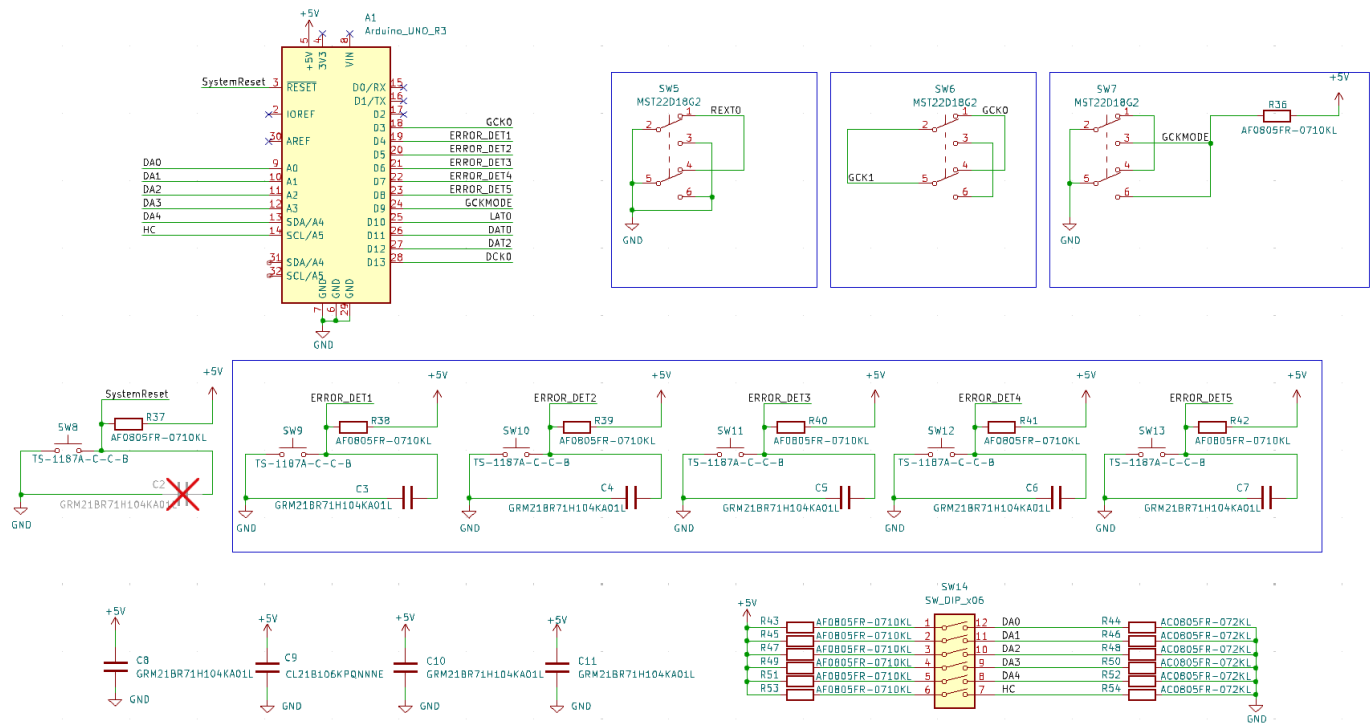
Evaluation Board Schematic

Figure 8. Evaluation Board Schematic

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Evaluation Board Layout
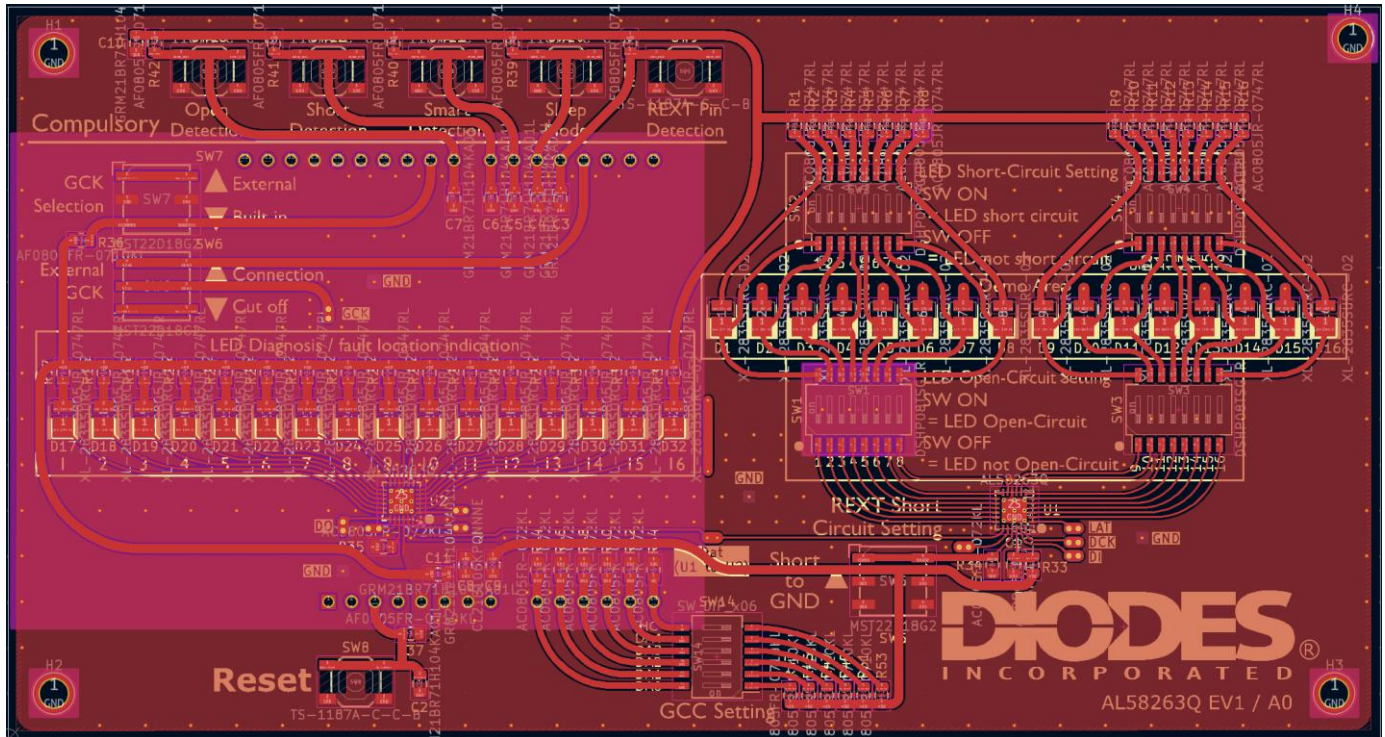
Figure 9. PCB Top Layer View
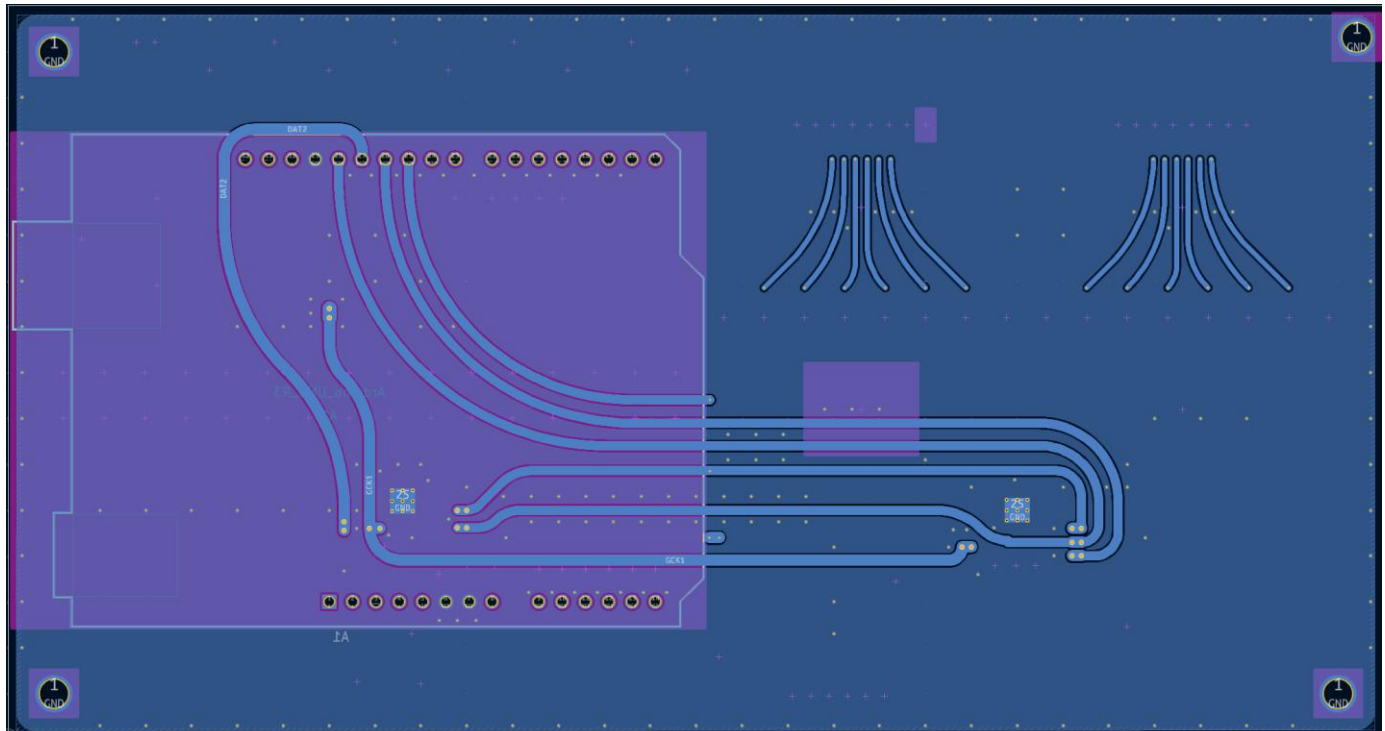
Figure 10. PCB Bottom Layer View

Bill of Material

References	Value	Footprint
A1	Arduino_UNO_R3	Arduino_UNO_R3
C1, C2, C3, C4, C5, C6, C7, C8, C10, C11	GRM21BR71H104KA01L	C_0805_2012Metric
C9	CL21B106KPQNNNE	C_0805_2012Metric
D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26, D27, D28, D29, D30, D31, D32	XL-2835SURC-02	LED_PLCC_2835
H1, H2, H3, H4	MountingHole	TestPoint_Plated_Hole_D3.0mm
LOGO1	DiodesLOGO	DiodesLOGO-40mm
R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32	AC0805JR-0747RL	R_0805_2012Metric
R33	AC0805FR-070RL	R_0805_2012Metric
R34, R35, R44, R46, R48, R50, R52, R54	AC0805FR-072KL	R_0805_2012Metric
R36, R37, R38, R39, R40, R41, R42, R43, R45, R47, R49, R51, R53	AF0805FR-0710KL	R_0805_2012Metric
SW1, SW2, SW3, SW4	DSHP08TSGER	SW_DIP_SPSTx08_Slide_Copal_CHS-08B_W7.62mm_P1.27mm
SW5, SW6, SW7	MST22D18G2	MST22D18G2
SW8, SW9, SW10, SW11, SW12, SW13	TS-1187A-C-C-B	SW_SPST_SKQG_WithStem
SW14	SW_DIP_x06	SW_DIP_SPSTx06_Slide_Copal_CHS-06B_W7.62mm_P1.27mm
U1, U2	AL58263Q	W-QFN4040-24/SWP (Type A1)

System Performance
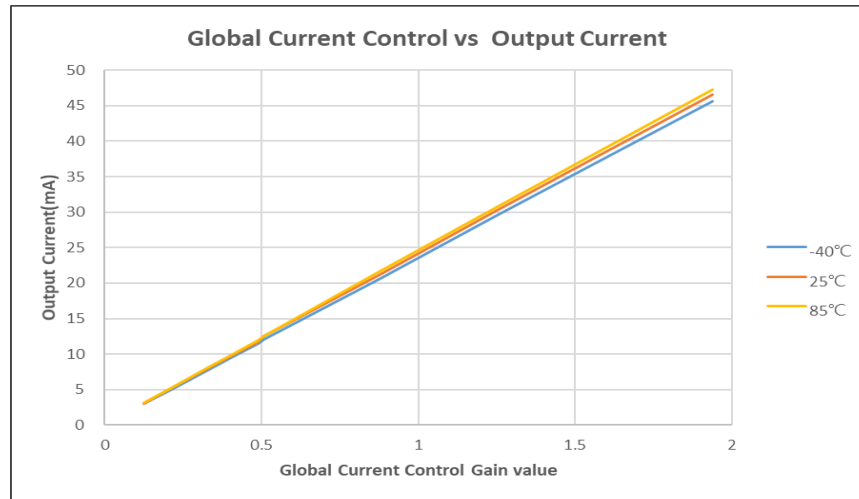
1. Global Current Control（VDD = 5.5V）

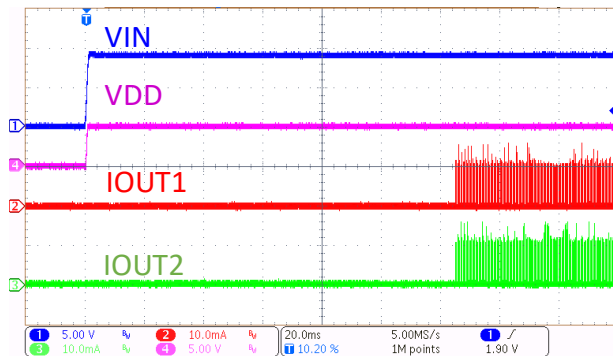**Figure 11. Global Current Control vs. Output Current**
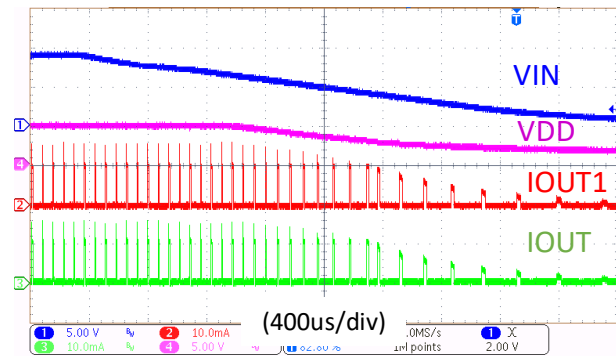
2. Turn ON/OFF Waveform

Figure12. Turn ON Waveform

Figure 13. Turn OFF Waveform

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