

## 24-CHANNEL LED DRIVER EVALUATION BOARD GUIDE

### DESCRIPTION

The IS31FL3239 is an LED driver with 24 constant current channels. Each channel can be pulse width modulated (PWM) by 16 bits for smooth LED brightness control. In addition, each channel has an 8-bit output current control register which allows fine tuning the current for rich RGB color mixing, e.g., a pure white color LED application. The maximum output current of each channel is 38mA, which can be adjusted by one 8-bit global control register.

Proprietary programmable technology is used to minimize audible noise caused by MLCC decoupling capacitors. All registers can be programmed via a high speed I2C (1MHz).

### FEATURES

- 2.7V to 5.5V VCC supply
- 1MHz I2C interface, automatic address increment function with readout function
- Four selectable I2C addresses
- Accurate Color Rendition
  - Selectable 16-bit PWM 256/1024/4096/65536
  - 8-bit Dot correction
  - 8-bit Global current adjust
- Open/short detect function
- 62kHz PWM frequency (8-bit PWM)
- Temperature detect function
- EMI Reduction Technology
  - Spread spectrum
  - Selectable 6 phase delay
  - 180 degree phase delay
- -40°C to +125°C temperature range
- QFN-32 (4mm×4mm) package

### QUICK START

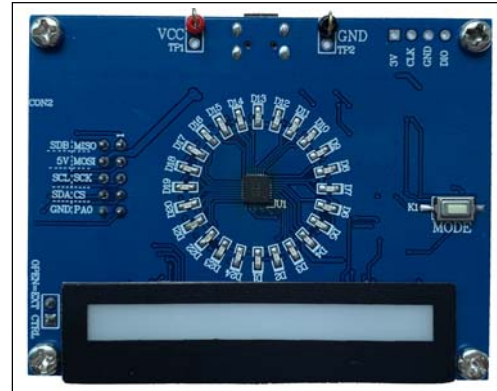


Figure 1: Photo of IS31FL3239-QFLS4 Evaluation Board

### RECOMMENDED EQUIPMENT

- 5.0V, 2A power supply

### ABSOLUTE MAXIMUM RATINGS

- ≤ 5.5V power supply

**Caution: Do not exceed the conditions listed above, otherwise the board will be damaged.**

### PROCEDURE

The IS31FL3239 evaluation board is fully assembled and tested. Follow the steps listed below to verify board operation.

**Caution: Do not turn on the power supply until all connections are completed.**

- 1) If using external DC power supply connect the ground terminal of the power supply to the evaluation board's GND pin and the positive terminal to the VCC pin. The evaluation board can also be powered via the Micro USB connector.
- 2) Short JP1 to disable external control.
- 3) Turn on the power supply/Plug in the Micro USB and pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.
- 4) Enter the desired mode of display by toggling the MODE button (K1).

### ORDERING INFORMATION

| Part No.            | Temperature Range            | Package           |
|---------------------|------------------------------|-------------------|
| IS31FL3239-QFLS4-EB | -40°C to +125°C (Industrial) | QFN-32, Lead-free |

Table 1: Ordering Information

**For pricing, delivery, and ordering information, please contact Lumissil's analog marketing team at [analog@Lumissil.com](mailto:analog@Lumissil.com) or (408) 969-6600.**

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### EVALUATION BOARD OPERATION

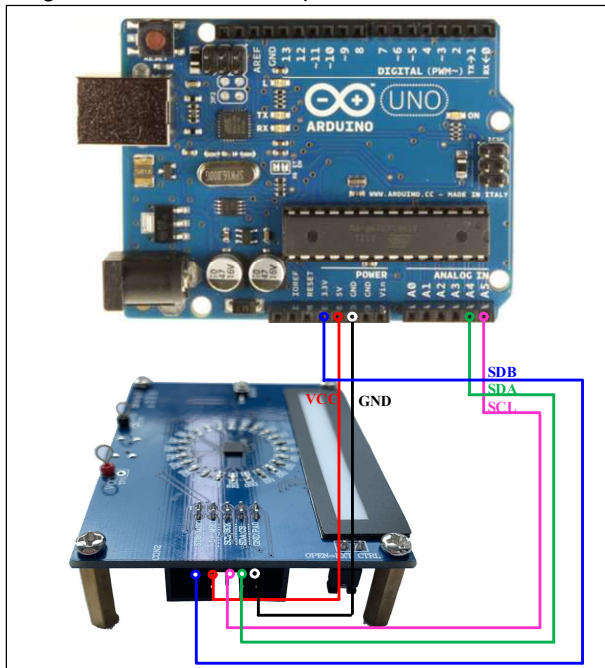
The IS31FL3239 evaluation board has six display mode. Toggling the MODE button (K1) can switch the modes.

- 1) (Default mode) Two groups single color LEDs chasing each other-A.
- 2) Two groups single color LEDs chasing each other-B.
- 3) Three groups single color LEDs chasing after each other.
- 4) Chasing cycle.
- 5) RGB LEDs (RGB1-RGB6) are breathing effect A-mixed color.
- 6) RGB LEDs (RGB1-RGB6) are breathing effect B.

**Note:** IS31FL3239 solely controls the FxLED function on the evaluation board.

### SOFTWARE SUPPORT

JP1 default setting is close circuit. If it is set to open, the on-board MCU will stop working. The I2C pins and SDB pin are set to High Impedance. External I2C and SDB signals can be connected to TP4 to control the IS31FL3239 LED driver. During external control mode, toggling the MODE button (K1) can switch the power of single blue color LED and power of RGB LED.



**Figure 2: Photo of Arduino UNO connected to Evaluation Board**

The steps listed below are an example using the Arduino for external control.

The Arduino hardware consists of an Atmel microcontroller with a bootloader allowing quick firmware updates. First download the latest Arduino Integrated Development Environment IDE (1.6.12 or greater) from [www.arduino.cc/en/Main/Software](http://www.arduino.cc/en/Main/Software). Also download the Wire.h library from [www.arduino.cc/en/reference/wire](http://www.arduino.cc/en/reference/wire) and verify that pgmspace.h is in the directory ...program Files(x86)/Arduino/hardware/tools/avr/avr/include/avr/. Then download the latest IS31FL3239 test firmware (sketch) from the Lumissil website <http://www.lumissil.com/products/led-driver/fxled>.

- 1) Open JP1.
- 2) Connect the 5 pins from Arduino board to IS31FL3239 EVB:
  - a) Arduino 5V pin to IS31FL3239 EVB VCC.
  - b) Arduino GND to IS31FL3239 EVB GND.
  - c) Arduino SDA (A4) to IS31FL3239 EVB SDA.
  - d) Arduino SCL (A5) to IS31FL3239 EVB SCL.
  - e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3239 EVB SDB, if Arduino use 5.0V MCU VCC, connect 5.0V or 3.3V to EVB SDB.

(Arduino UNO MCU VCC is 5V, so SDB can be 5V or 3.3V)

- 3) Use the test code in appendix I or download the test firmware (sketch) from the Lumissil website, a .txt file and copy the code to Arduino IDE, compile and upload to Arduino.
- 4) Run the Arduino code and the initial mode will change the Blue LED brightness every second.
- 5) During external control mode, toggling the MODE button (K1) can switch the power of single color LEDs and power of RGB LEDs.

**Please refer to the datasheet to get more information about IS31FL3239.**

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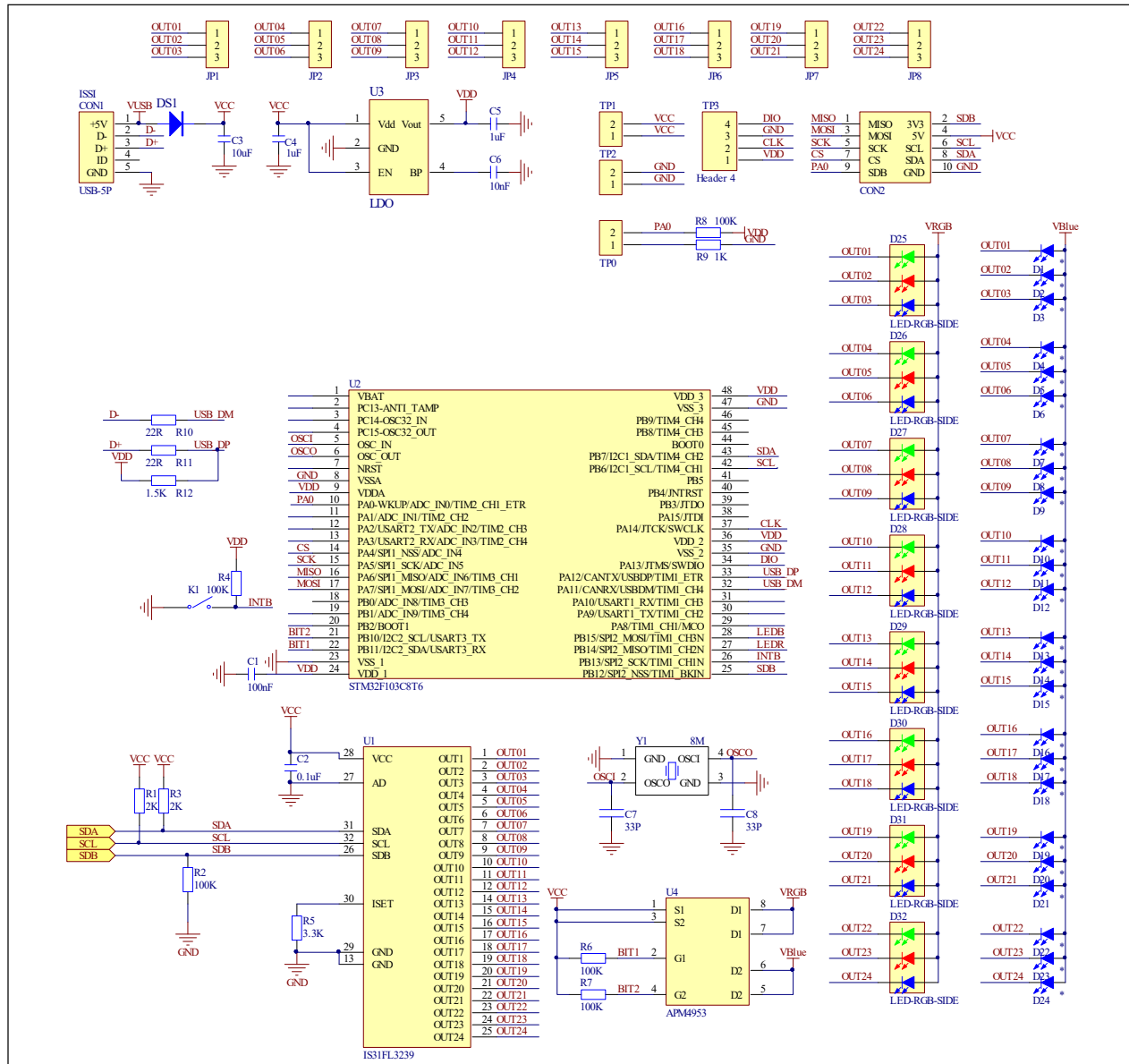


Figure 3: IS31FL3239 Application Schematic

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### BILL OF MATERIALS

| Name       | Symbol             | Description            | Qty | Supplier  | Part No.                                       |
|------------|--------------------|------------------------|-----|-----------|--|
| LED Driver | U1                 | 24CH FxLED Driver      | 1   | Lumissil  | IS31FL3239                                     |
| MCU        | U2                 | Microcontroller        | 1   | STM       | STM32F103C8T6                                  |
| LDO        | U3                 | 3.0V LDO               | 1   | SGMICRO   | SGM2019-3.0YN5G                                |
| PMOS       | U4                 | Dual PMOS              | 1   | ANPEC     | APM4953  |
| Crystal    | Y1                 | Crystal, 8MHz          | 1   | HLX       | HC-49S   |
| LED        | D1~D24             | Diode, LED Blue, SMD   | 24  | Everlight | 19-217/BHC-AN1P2/3T                            |
| LED        | D25~D32            | Diode, LED RGB, SMD    | 8   | Everlight | 99-235/RSGBB7C-A22/2D<br>or<br>99-235/RGBC/TR8 |
| Diode      | DS1                | Diode, SMD             | 1   | DIODES    | DFLS240  |
| Resistor   | R1,R3              | RES,2k,1/10W,±5%,SMD   | 1   | Yageo     | RC0603JR-072KL                                 |
| Resistor   | R2,R4,R6,<br>R7,R8 | RES,100k,1/10W,±5%,SMD | 5   | Yageo     | RC0603JR-07100KL                               |
| Resistor   | R5                 | RES,3.3k,1/10W,±5%,SMD | 1   | Yageo     | RC0603JR-073K3L                                |
| Resistor   | R9                 | RES,1k,1/10W,±5%,SMD   | 1   | Yageo     | RC0603JR-071KL                                 |
| Resistor   | R10, R11           | RES,22R,1/10W,±5%,SMD  | 1   | Yageo     | RC0603JR-0722RL                                |
| Resistor   | R12                | RES,1.5k,1/10W,±5%,SMD | 1   | Yageo     | RC0603JR-071K5L                                |
| Capacitor  | C1,C2              | CAP,100nF,16V,±20%,SMD | 2   | Yageo     | CC0603MRX7R7BB104                              |
| Capacitor  | C3                 | CAP,10µF,16V,±20%,SMD  | 1   | Yageo     | CC0603MRX5R7BB106                              |
| Capacitor  | C4,C5              | CAP, 1µF,16V,±10%,SMD  | 2   | Yageo     | CC0603KRX7R7BB105                              |
| Capacitor  | C6                 | CAP,10nF,16V,±10%,SMD  | 1   | Yageo     | CC0603KPX7R7BB103                              |
| Capacitor  | C7, C8             | CAP,33pF,50V,±5%,SMD   | 2   | Yageo     | CQ0603JRNPO9BN360                              |
| Button     | K1                 | Button SMD             | 1   |           |  |

*Bill of Materials, refer to Figure 3 above.*

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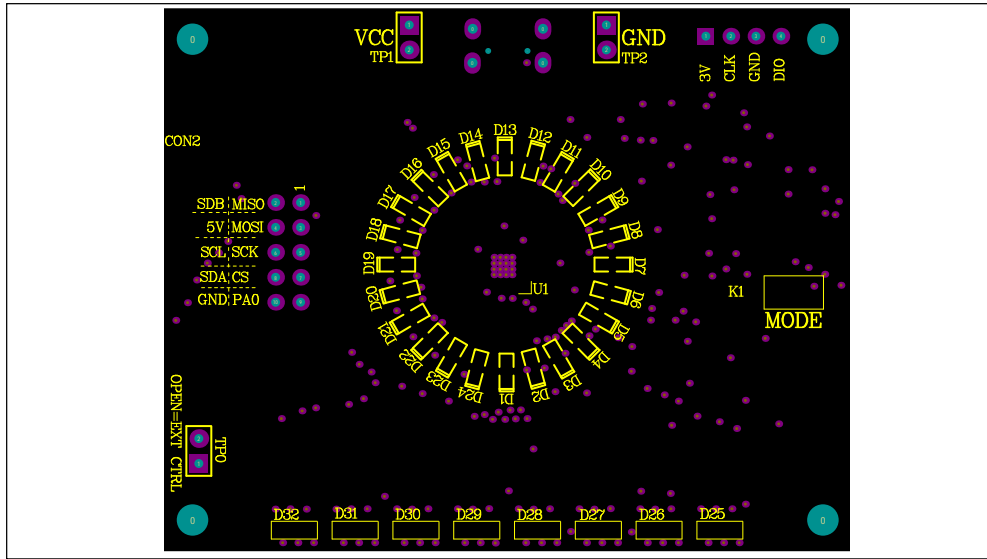


Figure 4: Board Component Placement Guide - Top Layer

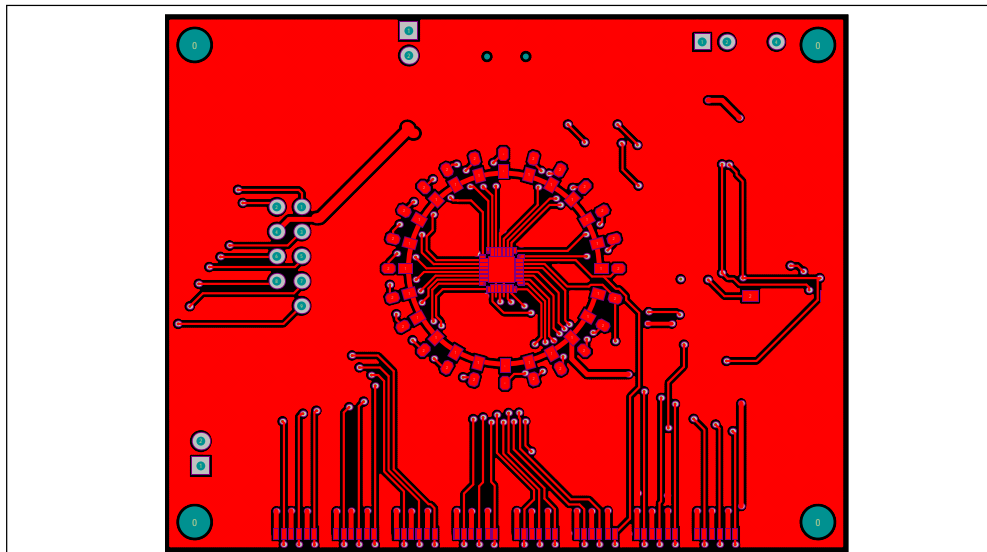


Figure 5: Board PCB Layout - Top Layer



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### REVISION HISTORY

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| Revision | Detail Information | Data       |
|----------|--------------------|------------|
| A        | Initial Release    | 2020.06.05 |
| B        | Update the BOM     | 2021.06.04 |

### APPENDIX I : IS31FL3239 Arduino Test Code V01A

```
#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0x68
//7 bit format is 0x3F

byte PWM_Gamma64[64]=
{
  0x00,0x01,0x02,0x03,0x04,0x05,0x06,0x07,
  0x08,0x09,0x0b,0x0d,0x0f,0x11,0x13,0x16,
  0x1a,0x1c,0x1d,0x1f,0x22,0x25,0x28,0x2e,
  0x34,0x38,0x3c,0x40,0x44,0x48,0x4b,0x4f,
  0x55,0x5a,0x5f,0x64,0x69,0x6d,0x72,0x77,
  0x7d,0x80,0x88,0x8d,0x94,0x9a,0xa0,0xa7,
  0xac,0xb0,0xb9,0xbf,0xc6,0xcb,0xcf,0xd6,
  0xe1,0xe9,0xed,0xf1,0xf6,0xfa,0xfe,0xff
};

void setup() {

  // put your setup code here, to run once:
  Wire.begin();
  Wire.setClock(400000); //I2C 400kHz
  // pinMode(4,OUTPUT); //SDB
  // digitalWrite(4,HIGH); //SDB_HIGH
  //delay(100); //keep 0.5s
  Init_FL3239();
}

void loop() {
  // put your main code here, to run repeatedly:
  // delay(50);
  Init_FL3239();
  IS31FL3239_mode1();//breath mode
}

void IS_IIC_WriteByte(uint8_t Dev_Add,uint8_t Reg_Add,uint8_t Reg_Dat)
{
  Wire.beginTransmission(Dev_Add/2);
  Wire.write(Reg_Add); // sends regaddress
  Wire.write(Reg_Dat); // sends regaddress
  Wire.endTransmission(); // stop transmitting
}

void Init_FL3239(void)
{
  uint8_t i = 0;
  for(i=0x4A;i<=0x6D;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0xFF);//write all scaling
  }
  IS_IIC_WriteByte(Addr_GND,0x6e,0xFF);//GCC
  IS_IIC_WriteByte(Addr_GND,0x49,0x00);//update PWM & congtrol registers
  IS_IIC_WriteByte(Addr_GND,0x00,0x01);//normal operation
}

void IS31FL3239_mode1(void)//white LED
{
  int i=0,j=0;
  for(j=0;j<=63;j++)
  {
    for(i=0x01;i<=0x47;i+=2)
    {
      IS_IIC_WriteByte(Addr_GND,i, PWM_Gamma64[j]);//write all PWM set 0x80
      IS_IIC_WriteByte(Addr_GND,0x49,0x00);//update PWM & congtrol registers
    }
    delay(10); //keep 0.5s
  }
  for(j=63;j>=0;j--)
  {
    for(i=0x01;i<=0x47;i+=2)
    {
```



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```
IS_IIC_WriteByte(Addr_GND,i, PWM_Gamma64[j]); //write all PWM set 0x80
IS_IIC_WriteByte(Addr_GND,0x49,0x00); //update PWM & congtrol registers
}
delay(10); //keep 0.5s
}
}
```