

12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

DESCRIPTION

The IS31FL3756 is a general purpose 12×n (n=1~3) LED Matrix programmed via 1MHz I2C compatible interface. Each LED can be dimmed individually with 12-bit PWM data and each current sink has 8-bit DC scaling (Color Calibration) data which allowing 4096 steps of linear PWM dimming and 256 steps of DC current adjustable level.

Additionally each LED open and short state can be detected, IS31FL3756 store the open or short information in Open-Short Registers. The Open-Short Registers allowing MCU to read out via I2C compatible interface. Inform MCU whether there are LEDs open or short and the locations of open or short LEDs.

FEATURES

- Supply voltage range: 2.7V to 5.5V
- 12 current sinks
- Support 12×n (n=1~3) LED matrix configurations
- Ultra-low operational current (700µA Typ. 900µA Max. at V_{CC}=3.6V)
- Accurate color rendition
 - 8/12-bit PWM for each dot
 - 8-bit correction/CS
 - 8-bit global current adjust
- SDB rising edge reset I2C module
- 60kHz PWM frequency (8-bit PWM mode)
- 1MHz I2C-compatible interface
- Individual open and short error detect function
- 180 degree phase delay operation to reduce power noise
- Spread spectrum
- De-ghost
- QFN-20 (3mm×3mm) package

QUICK START



Figure 1: Photo of IS31FL3756-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 IS31FL3756 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) Short P1 (OPEN=EXT CTRL) to enable the control of on board MCU (default status).
- 2) Connect the 5V DC power to VCC / GND in TP1/TP2, or plug in the USB power input to micro-USB (CON1).
- 3) Turn on the power supply, pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.

ORDERING INFORMATION

| Part No. | Temperature Range | Package |
|---------------------|------------------------------|-------------------|
| IS31FL3756-QFLS4-EB | -40°C to +125°C (Industrial) | QFN-20, Lead-free |

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contacts Lumissil's analog marketing team at analog@Lumissil.com or (408) 969-6600.

12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

EVALUATION BOARD OPERATION

The IS31FL3756 evaluation board has three display modes. Press K1 to switch configurations.

- 1) Rainbow mode(default).
- 2) Three colors breath mode 1.
- 3) Three colors breath mode 2.
- 4) White mode.

Note: IS31FL3756 solely controls the FxLED function on the evaluation board.

SOFTWARE SUPPORT

EXT CTRL (P1) default setting is close circuit. If it is set to open, the on-board MCU will configure the I2C pins and SDB pin to High Impedance and sleep. External I2C and SDB signals can be connected to CON2 to control the IS31FL3756 LED driver.

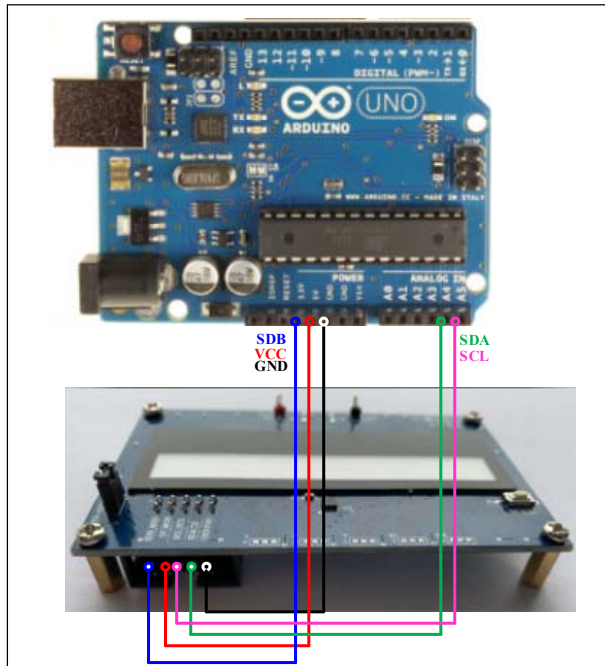


Figure 2: Photo of Arduino UNO connected to Evaluation Board

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. Also download the Wire.h library from 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 IS31FL3756 test firmware (sketch) from the Lumissil website <http://www.lumissil.com/products/led-driver/fxled>.

- 1) Open EXT CTRL (P1).
- 2) Connect the 5 pins from Arduino board to IS31FL3756 EVB:
 - a) Arduino 5V pin to IS31FL3756 EVB VCC.
 - b) Arduino GND to IS31FL3756 EVB GND.
 - c) Arduino SDA (A4) to IS31FL3756 EVB SDA.
 - d) Arduino SCL (A5) to IS31FL3756 EVB SCL.
 - e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3756 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 for desired mode setting by Arduino code.

Please refer to the datasheet to get more information about IS31FL3756.

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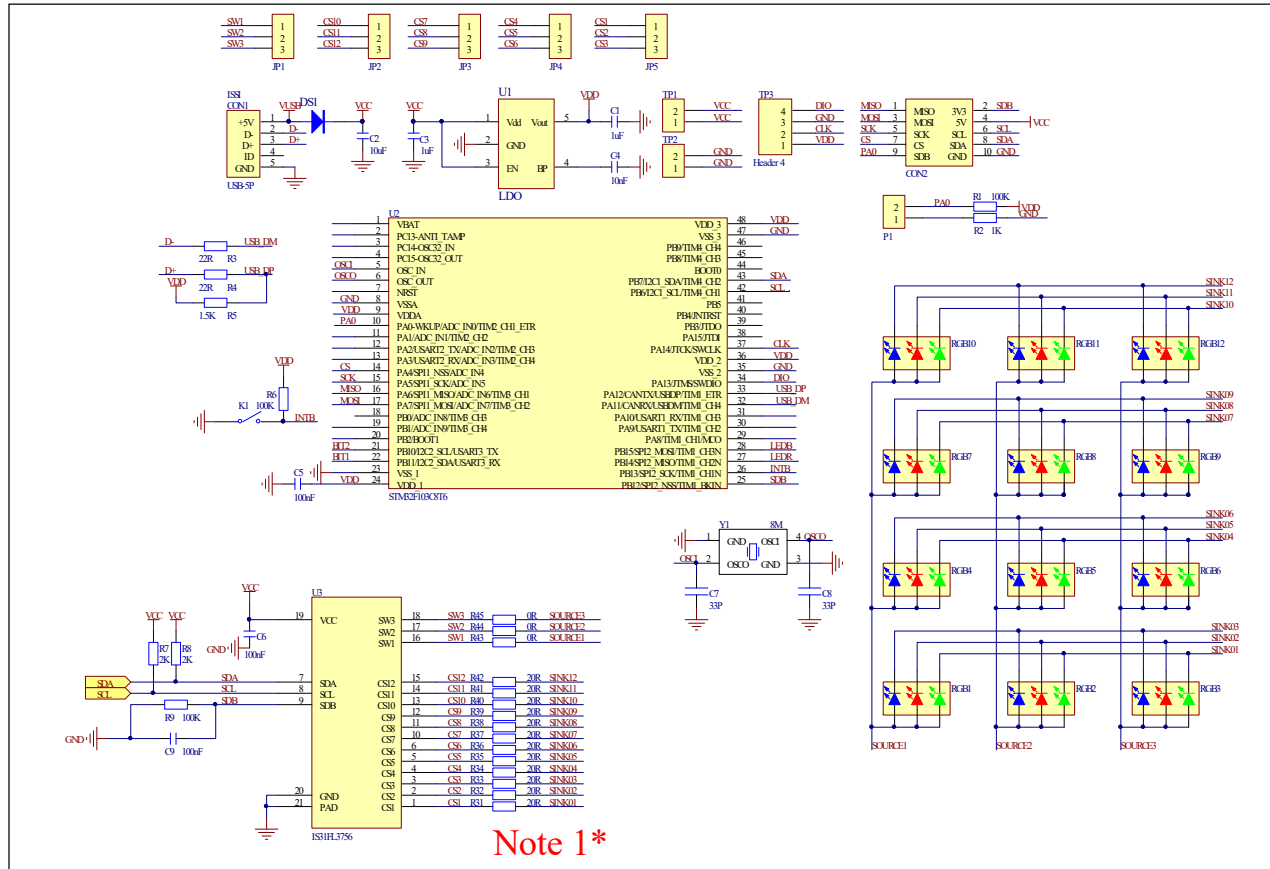


Figure 3: IS31FL3756 Application Schematic

12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

BILL OF MATERIALS

IS31FL3756

| Name | Symbol | Description | Qty | Supplier | Part No. |
|------------|---|-----------------------------------|-----|-----------|--|
| LDO | U1 | 3.0V LDO | 1 | SGMICRO | SGM2019-3.0YN5G |
| MCU | U2 | Microcontroller | 1 | STM | STM32F103C8T6 |
| LED Driver | U3 | Matrix LED Driver | 1 | Lumissil | IS31FL3756 |
| Crystal | Y1 | Crystal, 8MHz | 1 | HLX | HC-49S |
| Diode | DS1 | Diode, SMD | 1 | DIODES | DFLS240 |
| LED | RGB1~ RGB12 | Diode, LED RGB, SMD | 12 | Everlight | 99-235/RSGBB7C-A22/2D or 99-235/RGBC/TR8 |
| Resistor | R1,R6,R9 | RES,100k,1/10W,±5%,SMD | 3 | Yageo | RC0603JR-07100KL |
| Resistor | R2 | RES,1k,1/10W,±5%,SMD | 1 | Yageo | RC0603JR-071KL |
| Resistor | R3,R4 | RES,22R,1/10W,±5%,SMD | 2 | Yageo | RC0603JR-0722RL |
| Resistor | R5 | RES,1.5k,1/10W,±5%,SMD | 1 | Yageo | RC0603JR-071K5L |
| Resistor | R7,R8 | RES,2k,1/10W,±5%,SMD | 2 | Yageo | RC0603JR-072KL |
| Resistor | R43,R44, R45 | RES,0R,1/10W,±5%,SMD | 3 | Yageo | RC0603JR-070RL |
| Resistor | R31,R33, R34,R36, R37,R39, R40,R42 | RES,20R,1/10W,±5%,SMD | 8 | Yageo | RC0603JR-0720RL |
| Resistor | R32,R35, R38,R41 | RES,20R,1/10W,±5%,SMD (Note 2) | 4 | Yageo | RC0603JR-0720RL |
| Capacitor | C1,C3 | CAP, 1µF,16V,±10%,SMD | 2 | Yageo | CC0603KRX7R7BB105 |
| Capacitor | C2 | CAP,10µF,16V,±20%,SMD | 1 | Yageo | CC0805KKX7R7BB106 |
| Capacitor | C4 | CAP,10nF,16V,±10%,SMD | 1 | Yageo | CC0603KPX7R7BB103 |
| Capacitor | C5,C6,C9 | CAP,100nF,16V,±20%,SMD | 3 | Yageo | CC0603MRX7R7BB104 |
| Capacitor | C7,C8 | CAP,33pF,50V,±5%,SMD | 2 | Yageo | CQ0603JRNPO9BN360 |
| Capacitor | C8,C9 | CAP,10µF,16V,±20%,SMD | 2 | Yageo | CC0805KKX7R7BB106 |
| Button | K1 | Button SMD | 1 | | |

Bill of Materials, refer to Figure 3 above.

Note 2: The value of these resistors on the evaluation board is 20Ω. For $PV_{CC}=5V$ and red LED application, prefer 51Ω for these resistors as shown in datasheet Figure 1.

12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

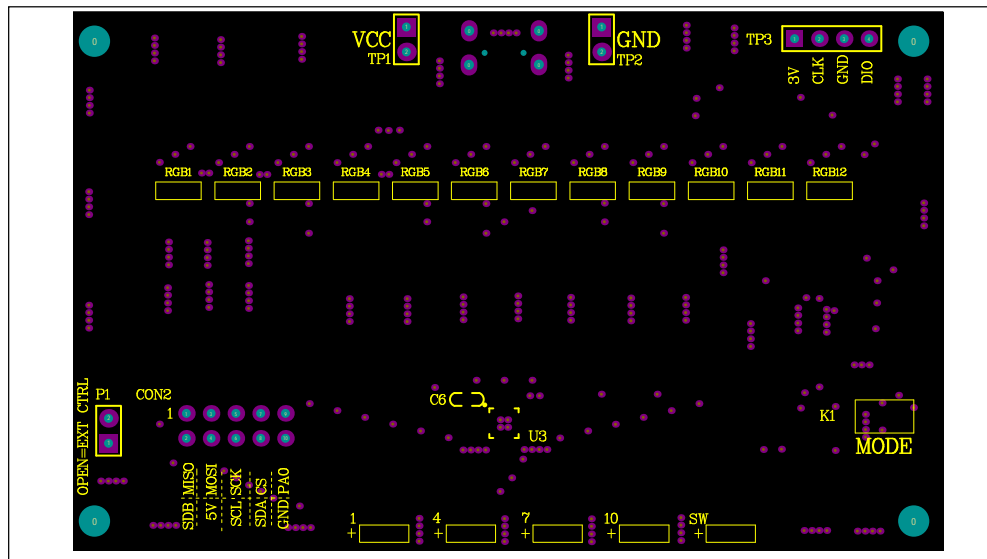


Figure 4: Board Component Placement Guide - Top Layer

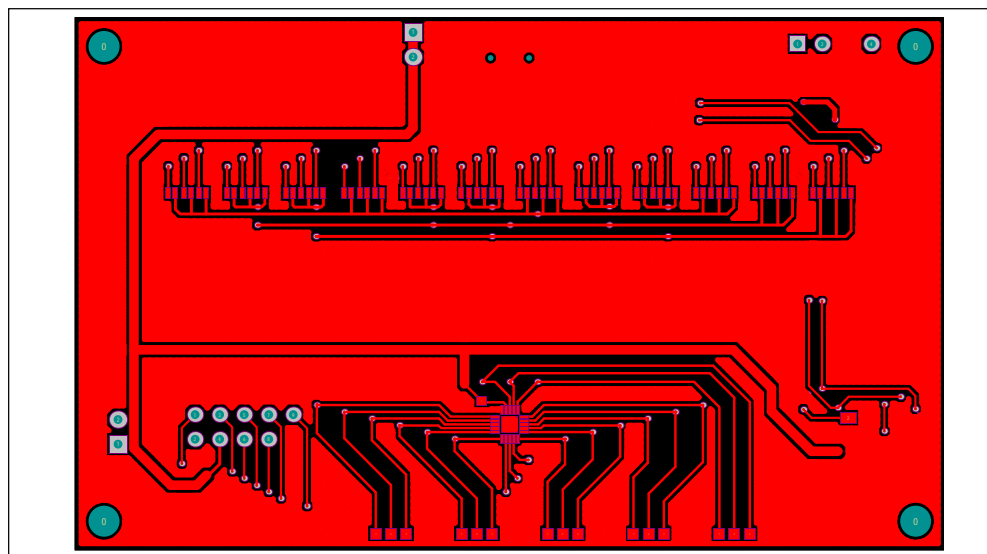


Figure 5: Board PCB Layout - Top Layer

12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

REVISION HISTORY

| Revision | Detail Information | Data |
|----------|--------------------|------------|
| A | Initial Release | 2021.06.02 |

APPENDIX I : IS31FL3756 Arduino Test Code V01A

```

#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0x88

int PWM_Gama64[128]=
{
  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,

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

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
  Init_FL3756();
}

void loop() {
  // put your main code here, to run repeatedly:
  IS31FL3756_mode1();//8-bit mode
  // IS31FL3756_mode2();//12-bit 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_FL3756(void)
{
  int i = 0;
  IS_IIC_WriteByte(Addr_GND,0x00,0x43);//Enable SSD 8-bit mode: 0x43 12-bit mode: 0x03
  IS_IIC_WriteByte(Addr_GND,0x01,0x80);//GCC
  IS_IIC_WriteByte(Addr_GND,0x61,0x00);//frequency select
  for(i=0x0E;i<=0x55;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0x00);//PWM
  }
  for(i=0x02;i<=0x0D;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0xFF);//SL
  }
}

void IS31FL3756_mode1(void)// 8-bit mode
{
  int i = 0;
  int j = 0;
  for (j=1;j<=127;j++)//all LED breath falling
  {
    for(i=0x0E;i<=0x54;i=i+2)

```


12-RGB/36-LED MATRIX LED DRIVER EVALUATION BOARD GUIDE

```

    {
        IS_IIC_WriteByte(Addr_GND,i,PWM_Gama64[j]); //set all PWM
    }
    delay(20); //20ms
}
}

void IS31FL3756_mode2(void) // 12-bit mode
{
    int i,j,k,l;

    for(k=0;k<=0x0f;k++) //all LED breath rising
    {
        for(l=0x0F;l<=0x55;l+=2)
        {
            IS_IIC_WriteByte(Addr_GND,l,k); //set all PWM
        }
        for(j=0;j<=255;j++) //all LED breath falling
        {
            for(i=0x0E;i<=0x54;i+=2)
            {
                IS_IIC_WriteByte(Addr_GND,i,j); //set all PWM
            }
            delay(2); //2ms
        }
    }

    for(k=0x0f;k>=0;k--) //all LED breath falling
    {
        for(l=0x0F;l<=0x55;l+=2)
        {
            IS_IIC_WriteByte(Addr_GND,l,k); //set all PWM
        }
        for(j=255;j>=0;j--) //all LED breath falling
        {
            for(i=0x0E;i<=0x54;i+=2)
            {
                IS_IIC_WriteByte(Addr_GND,i,j); //set all PWM
            }
            delay(2); //2ms
        }
    }
}
}
}

```