DESCRIPTION

The IS31FL3737B is a general purpose 12×12 LEDs matrix driver with 1/12 cycle rate. The device can be programmed via an I2C compatible interface. Each LED can be dimmed individually with 8-bit PWM data which allowing 256 steps of linear dimming.

IS31FL3737B features 3 Auto Breathing Modes which are noted as ABM-1, ABM-2 and ABM-3. For each Auto Breathing Mode, there are 4 timing characters which include current rising / holding / falling / off time and 3 loop characters which include Loop-Beginning / Loop-Ending / Loop-Times. Every LED can be configured to be any Auto Breathing Mode or No-Breathing Mode individually.

FEATURES

- Supply voltage range from 2.7V to 5.5V
- Programmable 12×12 (48 RGBs) matrix size with de-ghost function
- Selectable 3 Auto Breath Modes for each dot
- Auto breath offers 128 steps gamma current, interrupt and state look up registers
- 1.05kHz/ 2.1kHz/ 4.2kHz/ 8.4kHz/ 26.7kHz PWM frequency option
- 256 steps global current setting
- Individual PWM control 256 steps
- Individual open and short error detect function
- QFN-40 (5mm×5mm)

QUICK START

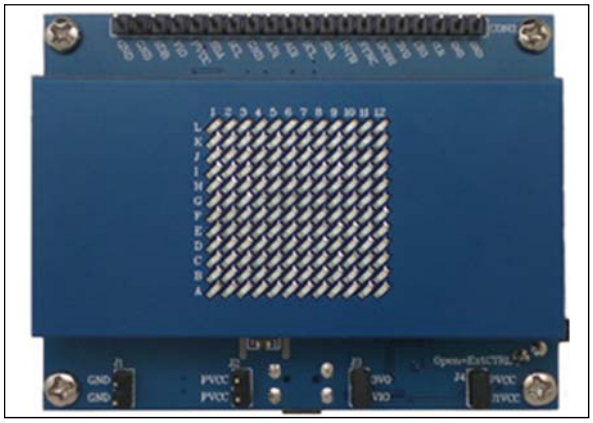

Figure 1: Photo of IS31FL3737B Evaluation Board

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 IS31FL3737B 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 J3 to connect 3VO and VIO.
2) Short J4 to connect PVCC and U1VCC.
3) Connect the 5VDC power to the connector (J1&J2).
4) Turn on the power supply/Plug in the Micro USB
   Pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31FL3737B-QFLS4-EB	-40°C to +125°C (Industrial)	QFN-40, 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.

EVALUATION BOARD OPERATION

The IS31FL3737B evaluation board has three animation display modes. Press K1 to switch configurations.

1) Line- rotate animation
2) Money animation
3) Butterfly animation
4) All led turn on

Note: IS31FL3737B solely controls the FxLED function on the evaluation board.

SOFTWARE CONTROL

J4 default setting is closed (short). If it is set to open, the U1 (LDO) will stop working and all the 3V, including the supply of MCU will be cut off, all the MCU's IO will be high impedance (open-drain) and external control is allowed.

The IS31FL3737B can set its I2C bus interface logic threshold based on the voltage on the VIO pin. An external VIO voltage in the range of $1.8V \le V_{IO} \le V_{CC}$ can be applied after removing (open) the J4 jumper.

The board comes with J4 default setting closed (short). If it is set to open, the user can connect an external VIO voltage supply, the external VIO voltage is recommended to equal to ex-IIC's high logic.

Follow the steps listed below for external control.

1) Open J4 to disconnect the power of U1, disable the 3V0 (3.0V).
2) Open J3 to disconnect the VIO to 3V0, and connect an external MCU VCC to VIO.
3) Pull-up or short the SDB to VIO (Can short by the jumper cap from J3 or J4).
4) Connect the 5VDC power to the connector (J1&J2, skip this step if use micro-USB as the power).
5) Turn on the power supply/Plug in the Micro USB
   Pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.
6) Start external IIC control.

Caution: If J4 is closed (shorted), user can't connect the user's MCU VCC to VIO directly, otherwise the user's MCU (maybe 1.8V) will connect to evaluation bard's VIO (3.0V) and maybe damaged.

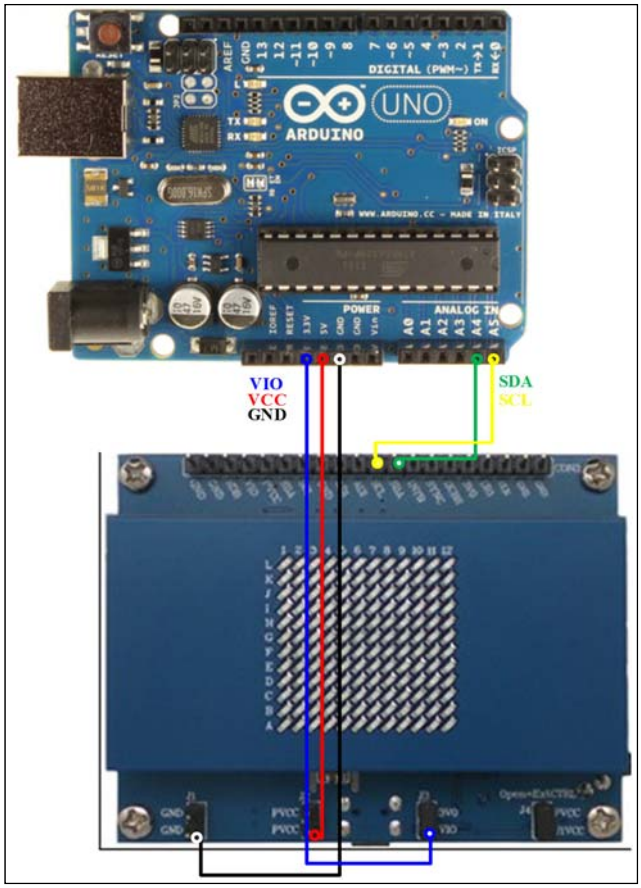

Figure 2: Photo of Arduino connect to Evaluation Board

Follow the steps listed below for external Arduino 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. Then download the latest IS31FL3737B test firmware (sketch) from the Lumissil website http://www.lumissil.com/products/led-driver/fxled.

1) Open J4 and J3.
2) Pull-up or short the SDB of Con3 to VIO (Use the jumper cap from J3 or J4).
3) Connect the 5 pins from Arduino board to IS31FL3737B EVB:
   a) Arduino VCC5V to IS31FL3737B EVB PVCC (Con3 or J2).
   b) Arduino GND to IS31FL3737B EVB GND (Con3 or J1).
   c) Arduino SDA to IS31FL3737B EVB SDA.
   d) Arduino SCL to IS31FL3737B EVB SCL.
   e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3737B EVB VIO, if Arduino use 5.0V MCU VCC, connect 5.0V to EVB VIO. (Arduino UNO MCU VCC is 5V, so SDB can be 5V or 3.3V)
4) Use the test code in appendix I or Download the

test firmware (sketch) form Lumissil website, a .txt file and copy the code to Arduino IDE and download to Arduino.

5) Run the Arduino code and initial mode has changed the brightness every second.
6) Default IS31FL3737B device address is 0xA0 (ADDR1=GND), if user want to change the device address, use the AD1 in Con3
   a) AD1=PVCC, device address=0xBE.
   b) AD1=SCL, device address=0xAA.
   c) AD1=SDA, device address=0XB4.

Please refer to the datasheet to get more information about IS31FL3737B.

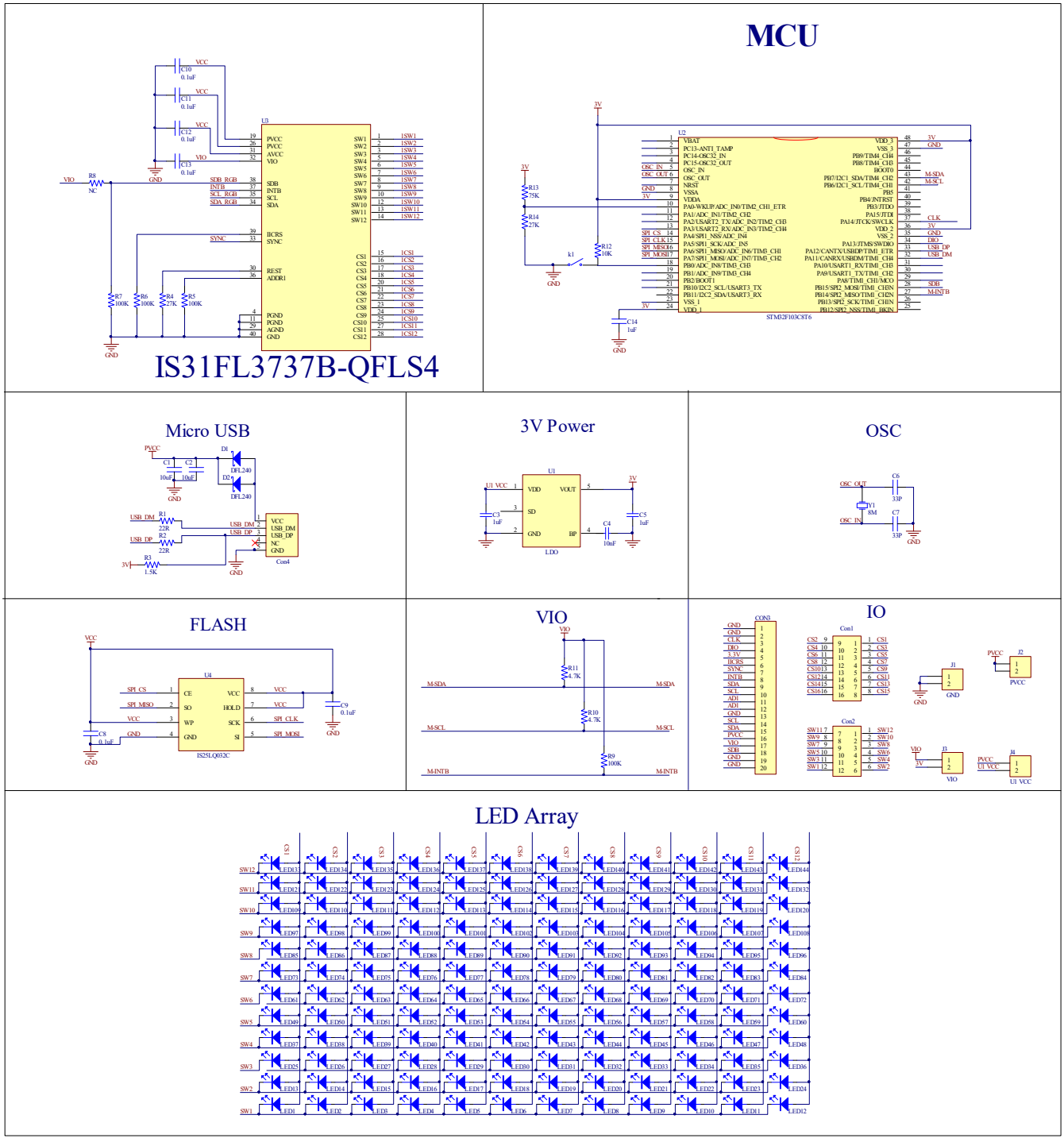

Figure 3: IS31FL3737B Application Schematic

BILL OF MATERIALS

Name	Symbol	Description	Qty	Supplier	Part No.
LDO	U1	Reduced voltage	1	SGMICRO	SGM2019-3.3V
MCU	U2	Microcontroller	1	STM	STM32F103C8T6
LED Driver	U3	Matrix LED Driver	1	Lumissil	IS31FL3737B
Flash	U4	Flash	1	Lumissil	IS25LQ032C
LED	LED1~LED144	Blue LED, SMD	144	Everlight	9-237/R6GHBHC-A01/2T
Diode	D1,D2	Diode, SMD	2	DIODES	DFLS240
Crystal	Y1	Crystal, 8MHz	1	JB	HC-49S
Resistor	R1,R2	RES,22R,1/16W,±5%,SMD	2	Yageo	RC0603JR-0722RL
Resistor	R3	RES,1.5k,1/16W,±5%, SMD	1	Yageo	RC0603JR-071K5L
Resistor	R4,R14	RES,27k,1/16W,±5%,SMD	2	Yageo	RC0603JR-0727KL
Resistor	R5,R6, R7,R9	RES,100k,1/16W,±5%, SMD	4	Yageo	RC0603JR-07100KL
Resistor	R8	NC			
Resistor	R10,R11	RES,4.7k,1/16W,±5%,SM D	2	Yageo	RC0603JR-074K7L
Resistor	R12	RES,10k,1/16W,±5%,SMD	1	Yageo	RC0603JR-0710KL
Resistor	R13	RES,75k,1/16W,±5%,SMD	1	Yageo	RC0603JR-0775KL
Capacitor	C1,C2	CAP,10uF,16V, ±20%,SMD	2	Yageo	CC0805MKX5R7BB106
Capacitor	C3,C5	CAP,1μF,16V,±20%,SMD	2	Yageo	CC0603KRX7R7BB105
Capacitor	C4	CAP,10nF,16V,±20%,SMD	1	Yageo	CC0603KRX7R7BB103
Capacitor	C6,C7	CAP,33pF,16V,±20%,SMD	2	Yageo	CQ0603JRNPO9BN330
Capacitor	C8,C9,C10, C11,C12,C13	CAP,0.1μF,16V,±20%,SMD	6	Yageo	CC0603MRX7R7BB104
Capacitor	C14	CAP,1μF,16V,±20%,SMD	1	Yageo	CC0805MKX7R7BB105
Button	K1	Button SMD	1		

Bill of Materials, refer to Figure 3 above.

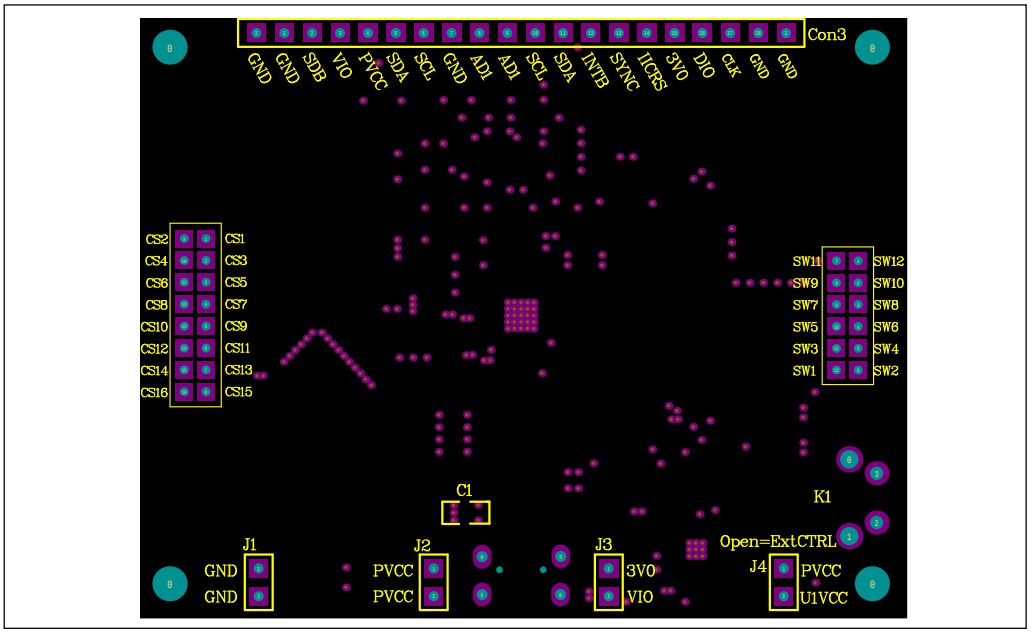

Figure 4: Board Component Placement Guide - Top Layer

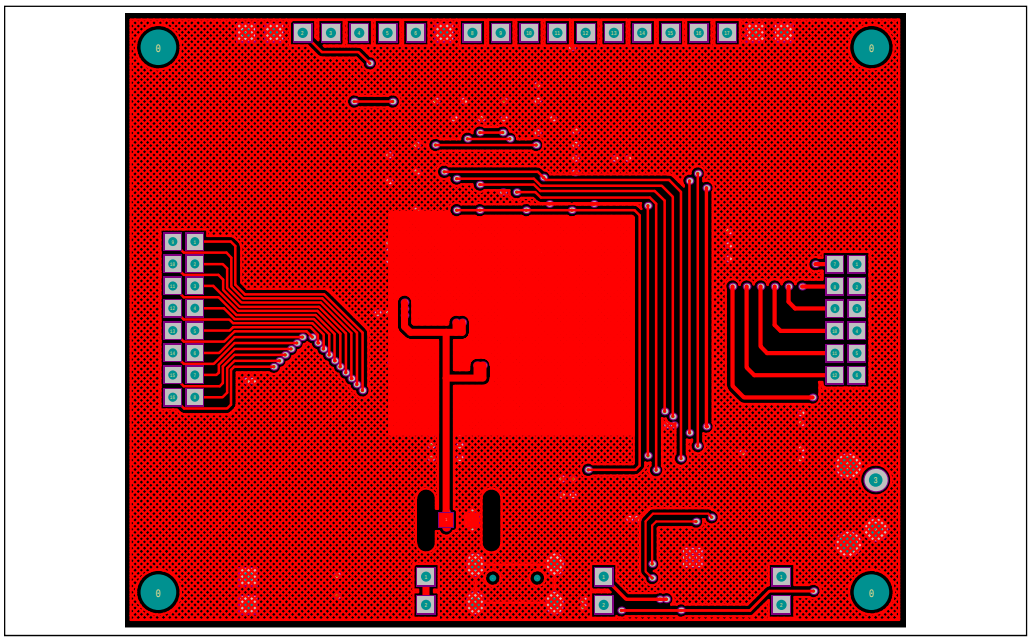

Figure 5: Board PCB Layout - Top Layer

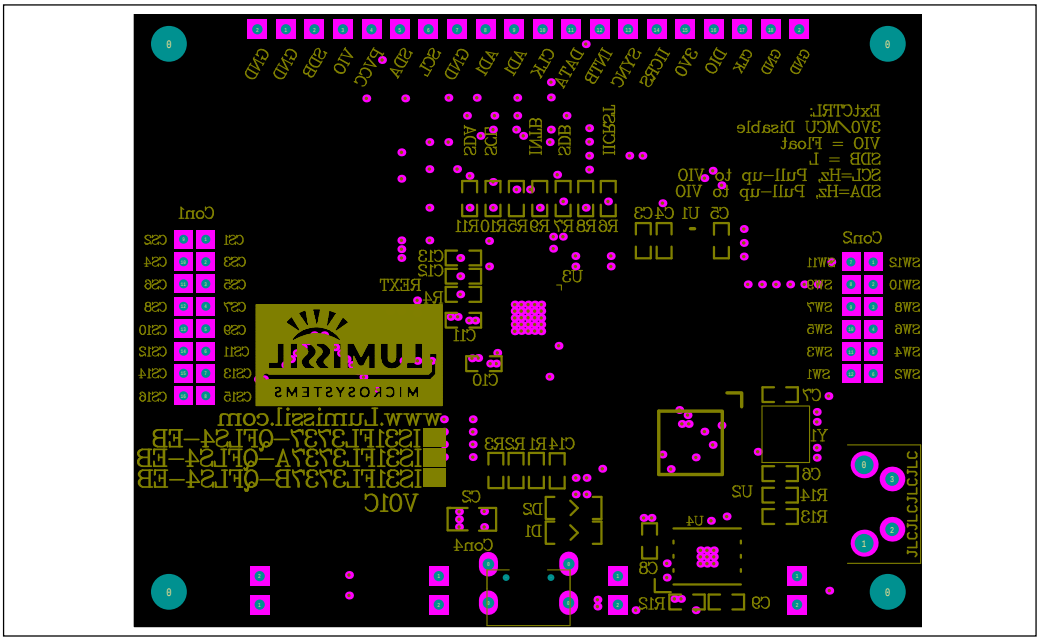

Figure 6: Board Component Placement Guide - Bottom Layer

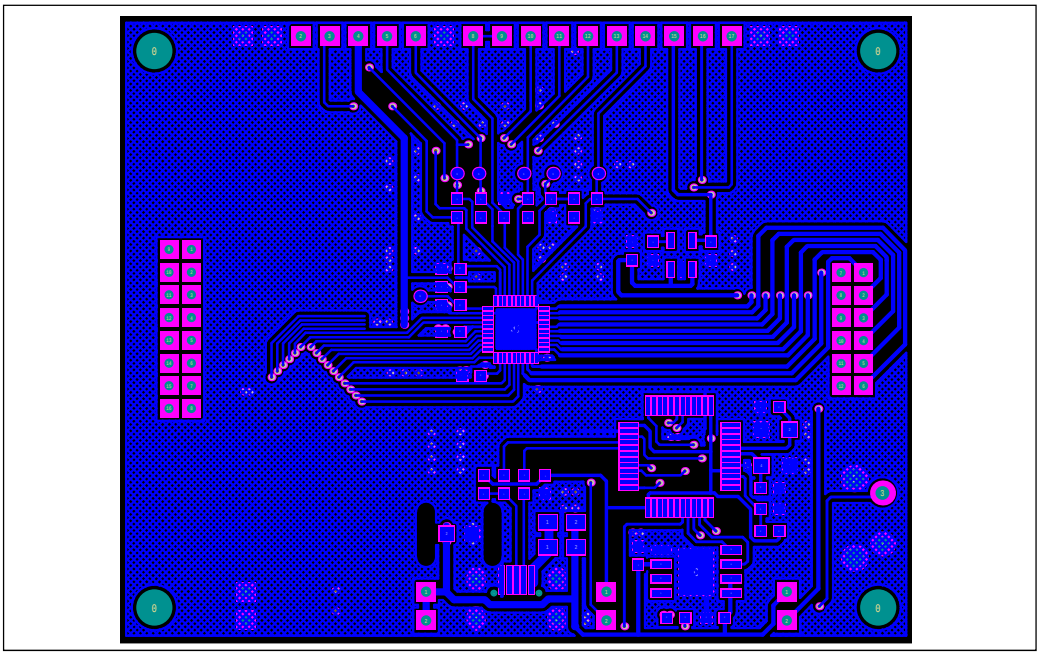

Figure 7: Board PCB Layout - Bottom Layer

Figure 8: LED Board Component Placement Guide - Top Layer

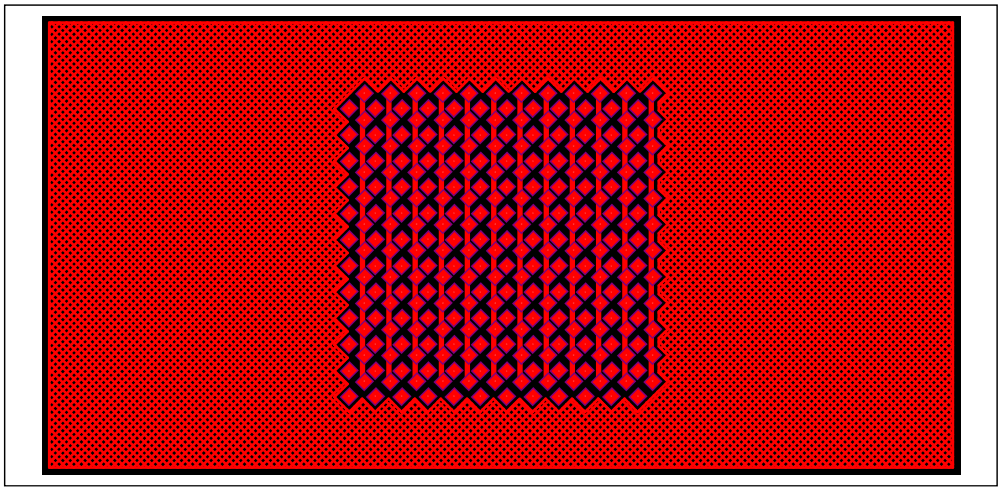

Figure 9: LED Board PCB Layout - Top Layer

Figure 10: LED Board Component Placement Guide - Bottom Layer

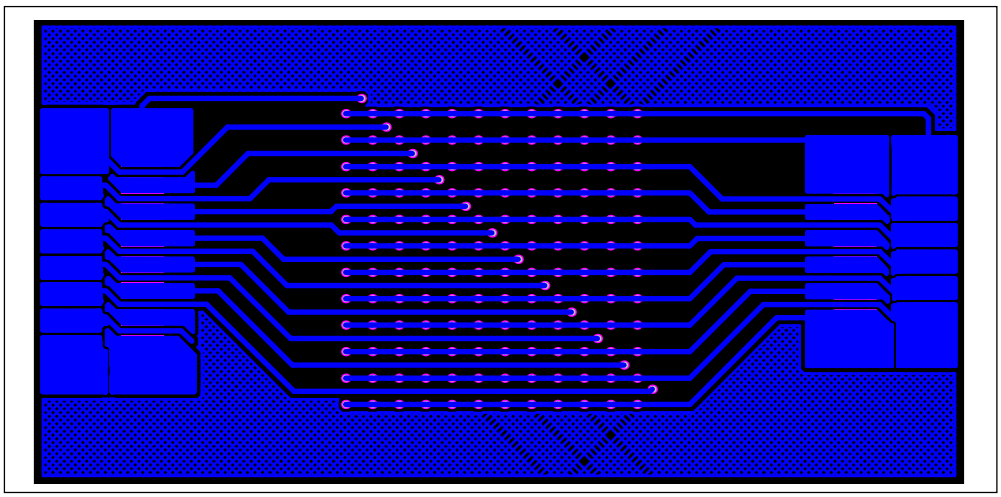

Figure 11: LED Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Date
A	Initial release	2019.12.05
B	Update the Arduino Code	2021.08.31

APPENDIX Ⅰ: IS31FL3737B Arduino Test Code V01B

```
#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND_GND 0xa0//AD1 open (R7 pull-low), ADDR2=GND
#define Addr_GND_VCC 0xa6//AD1 = VIO, ADDR2=GND
#define Addr_GND_SCL 0xa2//AD1 = SCL, ADDR2=GND
#define Addr_GND_SDA 0xa4//AD1 = SDA, ADDR2=GND

void setup()
{
  Wire.begin();
  Wire.setClock(800000);//I2C 800kHz
  IS31FL3737B_init();
}

void loop()
{
   IS31FL3737B_Test_mode1();//breath mode
}

void IS_IIC_WriteByte(uint8_t Dev_Add,uint8_t Reg_Add,uint8_t Reg_Dat)
{
  Wire.beginTransmission(Dev_Add/2); // transmit to device address
  Wire.write(Reg_Add); // sends register address
  Wire.write(Reg_Dat); // sends register data
  Wire.endTransmission(); // stop transmitting
}

void IS31FL3737B_init(void)//white LED
{
  uint8_t i;
  IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//Unlock FDh
  IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x03);//Turn to page 3: function registers
  IS_IIC_WriteByte(Addr_GND_GND,0x00,0x00);//Enable software shutdown

  IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//Unlock FDh
  IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x00);// Turn to page 0: control registers
  for(i=0;i<0x18;i=i+1)IS_IIC_WriteByte(Addr_GND_GND,i,0xff);//open all LED
  //can use buffer write type as figure 7 in datasheet

  IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//unlock FDh
  IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x01);//Turn to page 1: PWM registers
  for(i=0;i<192;i++)IS_IIC_WriteByte(Addr_GND_GND,i,0x00);//Set PWM data to 0
  //can use buffer write type as figure 7 in datasheet
```

```
    IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//unlock FDh
    IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x03);//Turn to page 3: function registers
    IS_IIC_WriteByte(Addr_GND_GND,0x00,0x11);//Release software shutdown to normal operation
    IS_IIC_WriteByte(Addr_GND_GND,0x01,0x80);//global current
}

void IS31FL3737B_Test_mode1(void)//white LED
{
    int i,t;
    while(1)
    {
    IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//unlock FDh
    IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x01);//Turn to page 1: PWM registers
    for(t=0;t<=255;t++)
    {
       for(i=0;i<192;i++)IS_IIC_WriteByte(Addr_GND_GND,i,t);//update all PWM with 0x10
    }
    delay(1000);                    // wait for a second

    IS_IIC_WriteByte(Addr_GND_GND,0xFE,0xc5);//unlock FDh
    IS_IIC_WriteByte(Addr_GND_GND,0xFD,0x01);//Turn to page 1: PWM registers
    for(t=255;t>=0;t--)
    {
       for(i=0;i<192;i++)IS_IIC_WriteByte(Addr_GND_GND,i,t);//update all PWM with 0x10
    }
    delay(1000);                    // wait for a second
    }
}
```