18×12 DOTS MATRIX LED DRIVER EVALUATION BOARD

DESCRIPTION

The IS31FL3763 is a general purpose 18 × 12 (n=2~12) LED Matrix programmed via 1MHz I2C or 12MHz SPI compatible interface. Each LED can be dimmed individually with 12-bit/8+4-bit/8-bit/6+2-bit PWM data and each color sink can have 8-bit DC scaling data which allow 256 steps of linear PWM dimming and each color sink has 256 steps of DC current adjustable level and precision for smooth LED brightness control. The maximum output current of each channel is designed to be 40mA, which can be adjusted by 8-bit x1 global control register.

Additionally, each LED open and short state can be detected, IS31FL3763 stores the open or short information in Open-Short Registers. The Open-Short Registers allow MCU to read out via I2C/SPI compatible interface. Inform MCU whether there are LEDs open or short and the locations of open or short LEDs. Proprietary algorithms are used in IS31FL3763 to minimize power bus noise caused by passive components on the power bus such as MLCC decoupling capacitor. All registers can be programmed via SPI (up to 12MHz) bus or I2C (1MHz) bus.

FEATURES

- Supply voltage range: 3V to 5.5V
- 18 current sinks (Maximum)
- Support 18×n (n=2~12) LED matrix configurations
- Individual 12-bit/8+4-bit/8-bit /6+2-bit PWM control steps
- Each color sink (CSy) 8-bit DC current steps
- Global 256 steps current setting
- SDB rising edge reset I2C module
- 24kHz scan frame rate (@6+2-bit PWM)
- 1MHz I2C-compatible interface & 12MHz SPI interface
- State lookup registers
- Random switching sequencing to mitigate power ripple, EMI, and audible noise
- For matrix scanning operation
  - Built-in de-ghosting circuit
  - Reduced inactive LED reverse bias to improve LED reliability
- Group phase shift (180-degree) to reduce audible noise and power ripple
- Support spread spectrum operation for PWM clock to reduce EMI
- Software shutdown mode
- Operating temperature: -40°C to 125°C
- QFN-40 (5mm×5mm) package
- RoHS & Halogen-Free Compliance
- TSCA Compliance

QUICK START

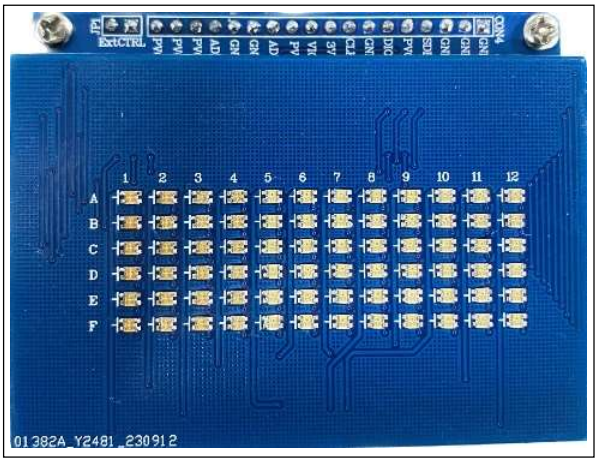

Figure 1: Photo of IS31FL3763 Evaluation Board

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 IS31FL3763 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 JP1 to enable the control of board MCU (default status).
2) Connect the 5VDC power to VCC/GND of CON4, or plug in the USB power input to micro-USB.
3) Turn on the power supply, pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.

EVALUATION BOARD OPERATION

The IS31FL3763 evaluation board has five display modes. Press K1 to switch configurations:

Note: See Appendix for each mode's detail.

1) (Default mode) Rainbow #1.
2) Rainbow #2.
3) White breath.
4) Change colors.

Note: IS31FL3763 solely controls the FxLED function on the evaluation board.

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31FL3763-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.

SOFTWARE SUPPORT

JP1 default setting is close circuit. If it is set to open, the on-board MCU will stop working. The SPI pins and SDB pin are set to High Impedance. External SPI and SDB signals can be connected to TP4 to control the IS31FL3763 LED driver.

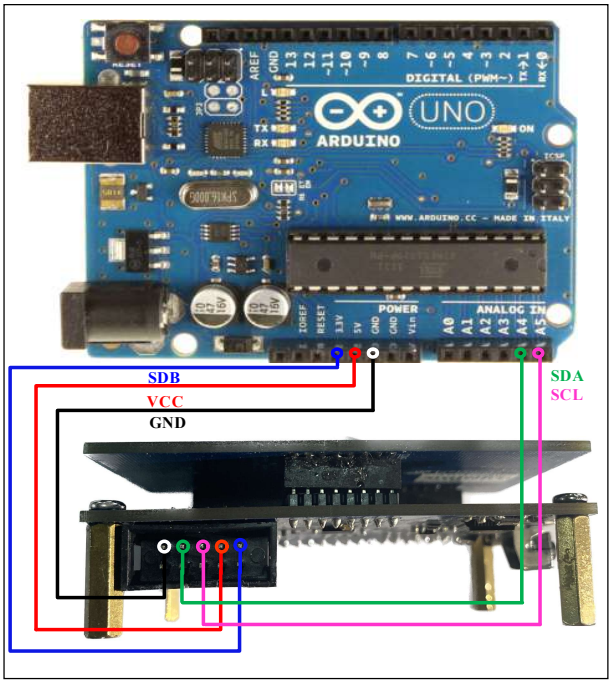

Figure 2: Photo of Arduino UNO connected to Evaluation Board

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 IS31FL3763 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 IS31FL3763 EVB:
   a) Arduino 5V pin to IS31FL3763 EVB VCC.
   b) Arduino GND to IS31FL3763 EVB GND.
   c) Arduino 3.3V pin to IS31FL3763 EVB SDB.
   d) Arduino SDA (A4) to IS31FL3763 EVB SCK.
   e) Arduino SCL (A5) to IS31FL3763 EVB MISO.
   f) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3763 EVB SDB, if Arduino use 5.0V MCU VCC, connect 5.0V to EVB SDB. (Arduino UNO is 5.0V, so SDB=5.0V)
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 RGB LED colors.

Please refer to the datasheet to get more information about IS31FL3763.

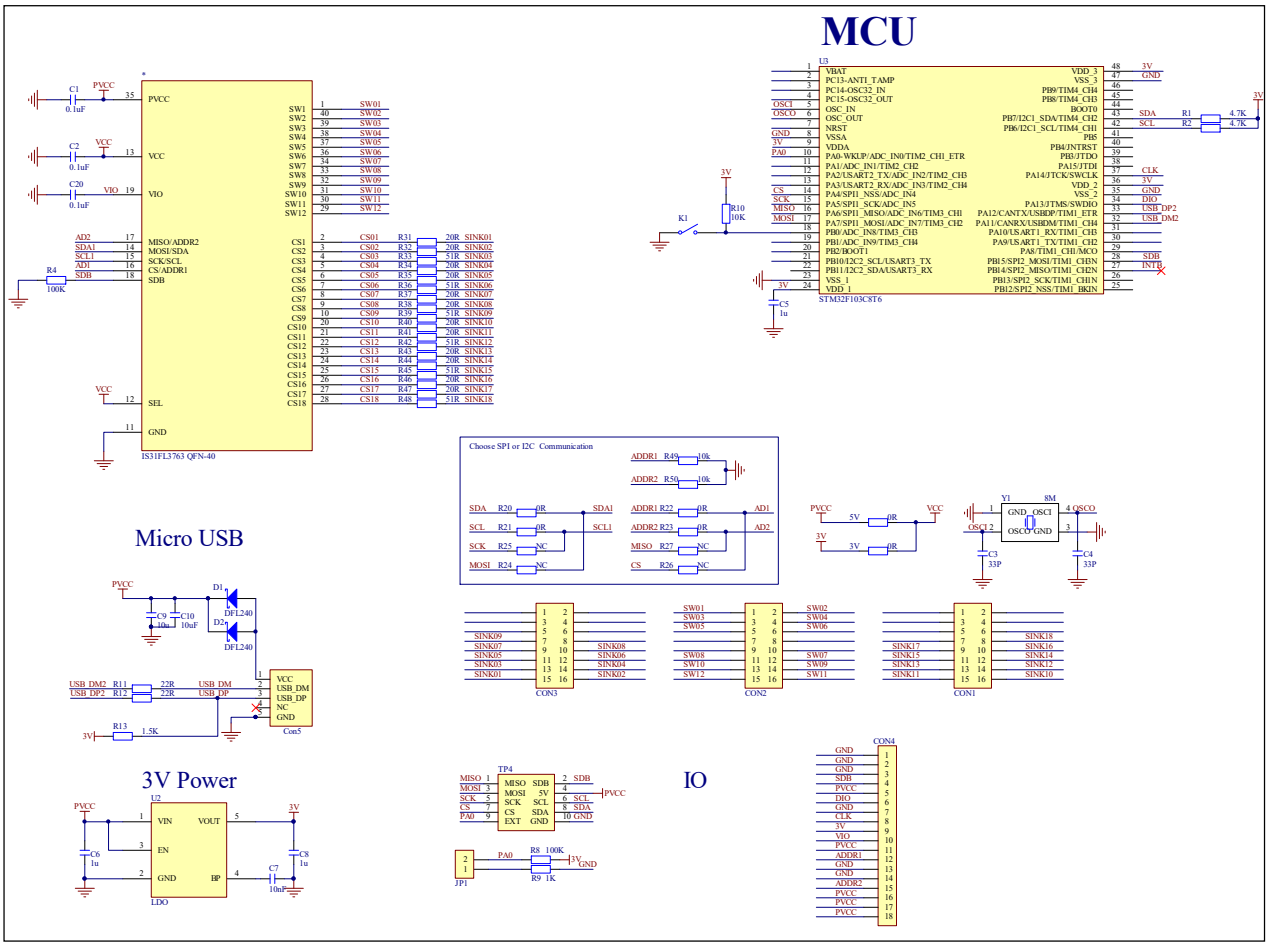

Figure 3: IS31FL3763 Application Schematic

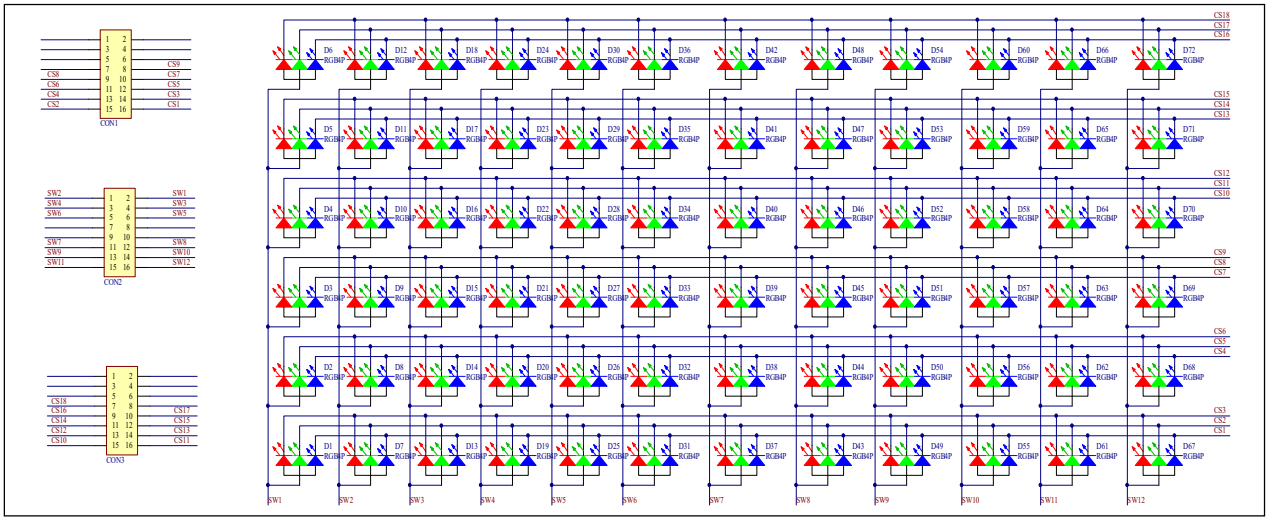

Figure 4: FxLED 6×12 ARRAY Application Schematic

BILL OF MATERIALS

IS31FL3763

Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U1	Matrix LED Driver	1	Lumissil	IS31FL3763
LDO	U2	Reduced voltage	1	SGMICRO	SGM2019-3.3V
MCU	U3	Microcontroller	1	STM	STM32F103C8T6
Diode	D1,D2	Diode, SMD	2	DIODES	DFLS240
Crystal	Y1	Crystal, 8MHz	1	JB	HC-49S
Resistor	R1,R2	RES,4.7k,1/10W,±5%,SMD	2	Yageo	RC0603JR-074K7L
Resistor	R4, R8, R14, R15	RES,100k,1/10W,±5%,SMD	4	Yageo	RC0603JR-07100KL
Resistor	R10,R49,R50	RES,10k,1/10W,±5%,SMD	1	Yageo	RC0603JR-0710KL
Resistor	R9	RES,1k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071KL
Resistor	R11,R12	RES,22R,1/16W,±5%,SMD	2	Yageo	RC0603JR-0722RL
Resistor	R13	RES,1.5k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071K5L
Resistor	R33, R36, R39, R42, R45, R48	RES,51R,1/20W,±5%,SMD	6	Yageo	RC0201JR-0751RP
Resistor	3V, 5V, R20, R21, R22, R23	RES,0R,1/10W,±5%,SMD (Note 2)	6	Yageo	RC0603JR-070RL
Resistor	R31, R32, R34, R35, R37, R38, R40, R41, R43, R44, R46, R47	RES,20R,1/10W,±5%,SMD	12	Yageo	RC0603JR-0720RL
Capacitor	C1,C2,C20	CAP,100nF,16V,±20%,SMD	3	Yageo	CC0603MRX7R7BB104
Capacitor	C3,C4	CAP,33pF,50V,±5%,SMD	2	Yageo	CQ0603JRNPO9BN330
Capacitor	C5,C6,C8	CAP, 1μF,16V,±10%,SMD	3	Yageo	CC0603KRX7R7BB105
Capacitor	C7	CAP,10nF,16V,±10%,SMD	1	Yageo	CC0603KRX7R7BB103
Capacitor	C9,C10	CAP,10μF,16V,±20%,SMD	2	Yageo	CC0603MRX5R7BB106
Button	K1	Button SMD	1		

Bill of Materials, refer to Figure 3 above.

FxLED 6×11 ARRAY

Name	Symbol	Description	Qty	Supplier	Part No.
Diode	D1~D66	RGB LED, SMD	72	Everlight	9-237/R6GHBHC-A01/2T

Bill of Materials, refer to Figure 4 above.

Note 2: IS31FL3763 uses I2C and SPI Interference and SDA, SCL, AD1, AD2 position need to short by 0R resistors.

Note 3: 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.

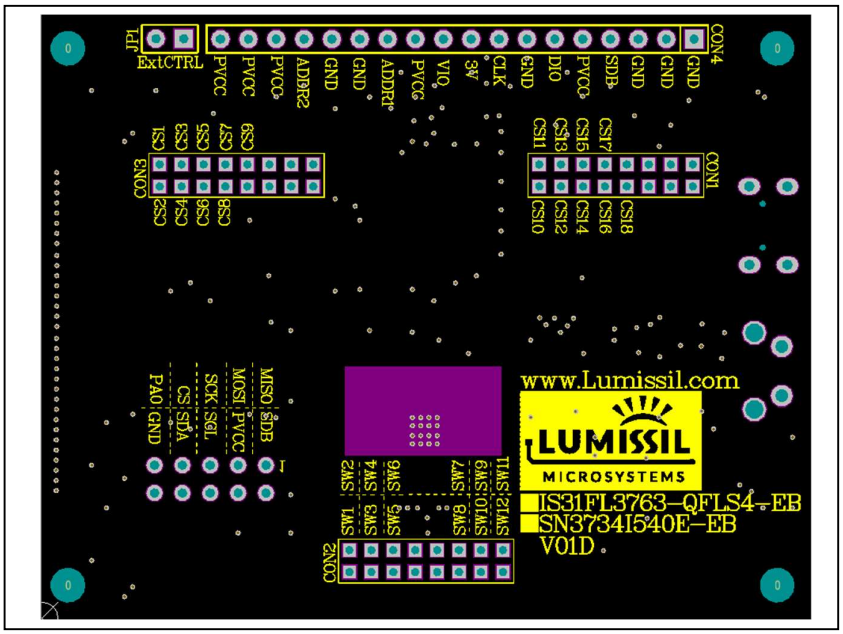

Figure 5: Board Component Placement Guide - Top Layer

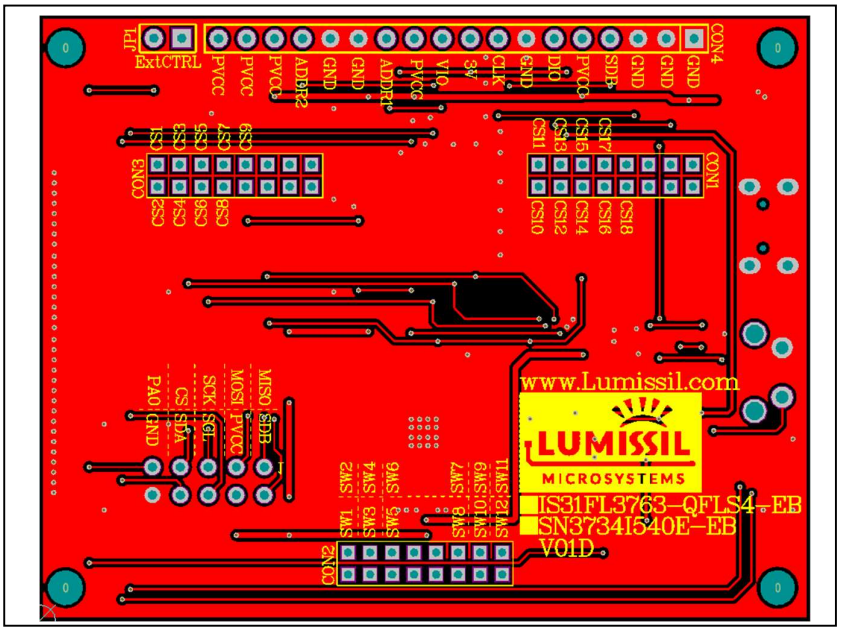

Figure 6: Board PCB Layout - Top Layer

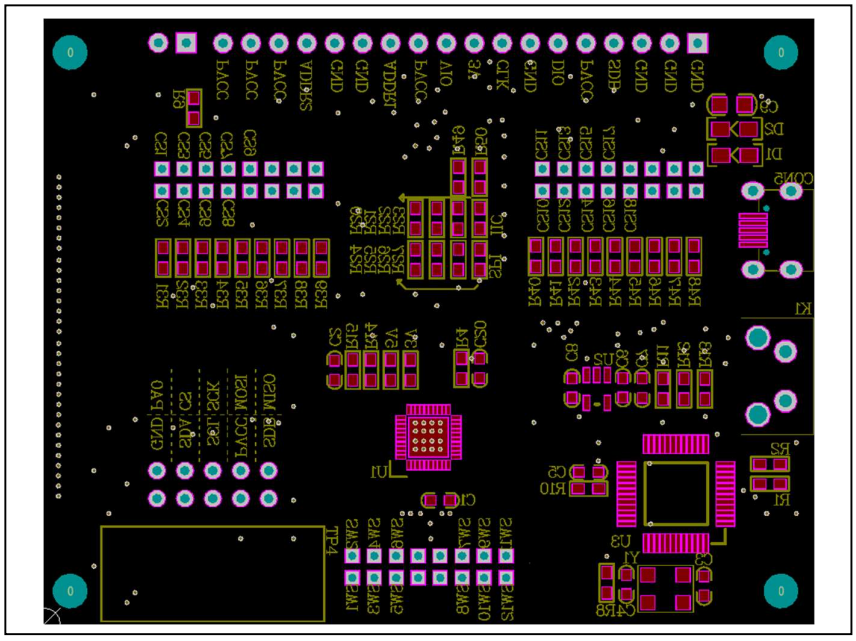

Figure 7: Board Component Placement Guide - Bottom Layer

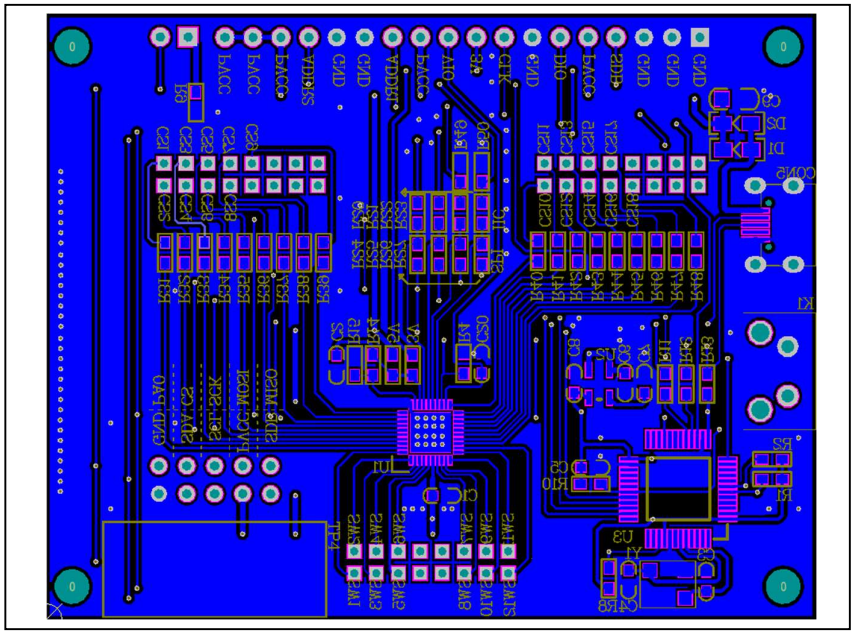

Figure 8: Board PCB Layout - Bottom Layer

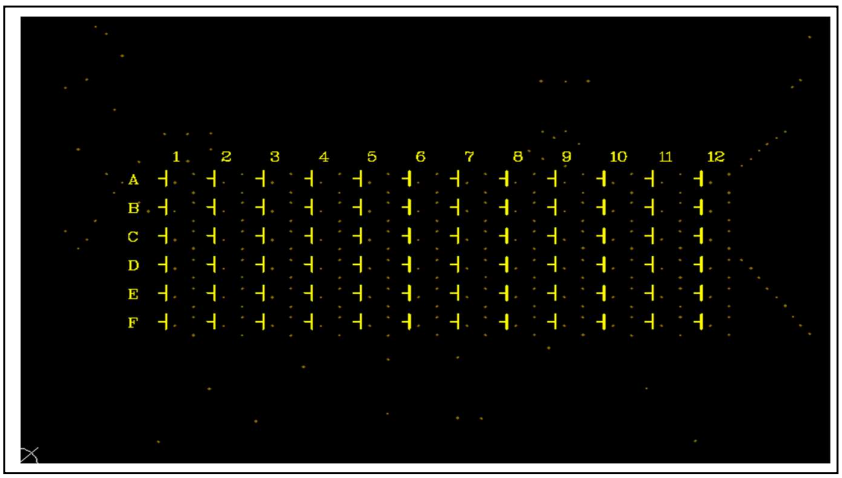

Figure 9: Board Component Placement Guide - Top Layer

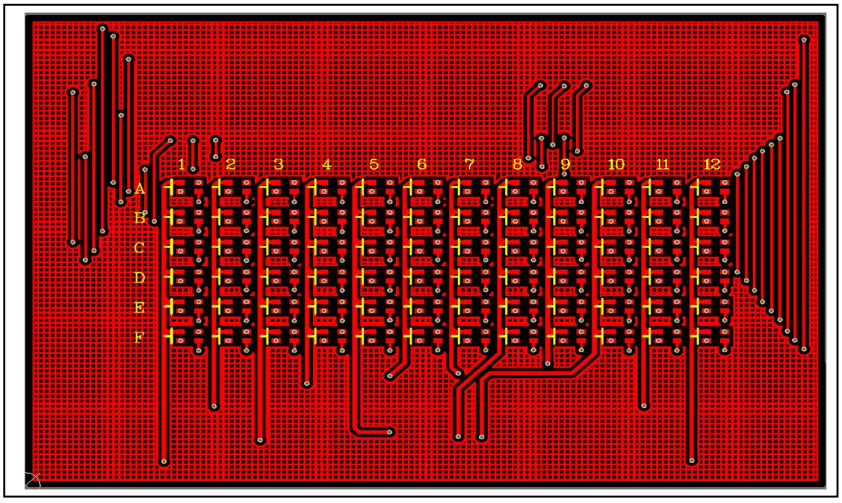

Figure 10: Board PCB Layout - Top Layer

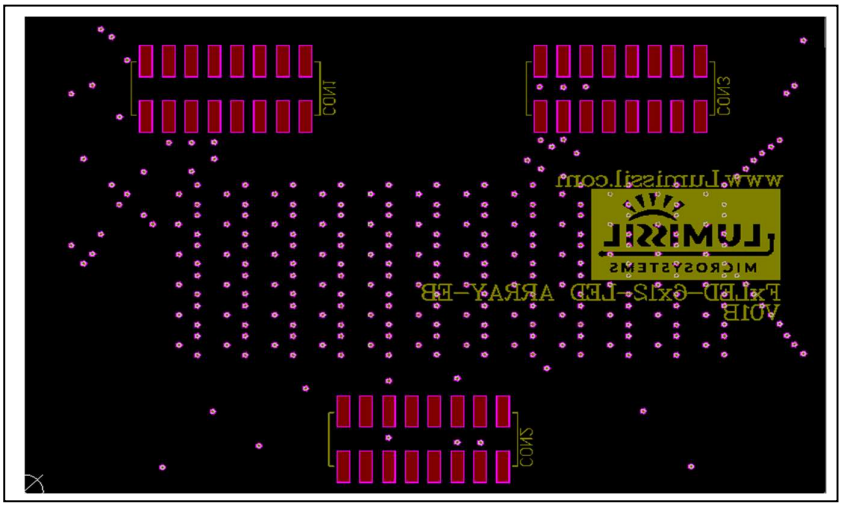

Figure 11: Board Component Placement Guide - Top Layer

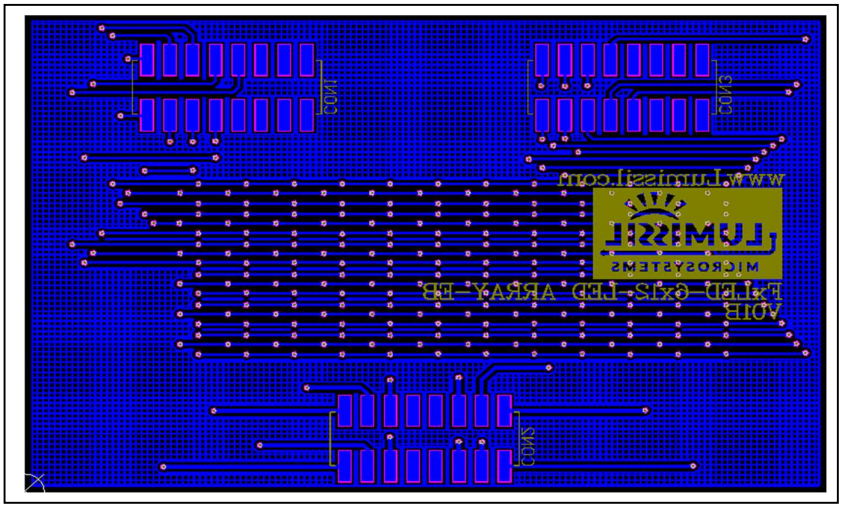

Figure 12: Board PCB Layout - Top Layer

REVISION HISTORY

Revision	Detail Information	Date
A	Initial release	2023.10.08
B	1. Update IS31FL3763 schematic 2. Update IS31FL3763 PCB Board Picture 3. Update IS31FL3763 Bill of Materials 4. Update IS31FL3763 Arduino Code	2024.06.06
C	1.Correct Photo of Arduino UNO connected to Evaluation Board(Figure2). 2.Feature Add RoHS & Halogen-Free Compliance and TSCA Compliance	2025.03.31

APPENDIX Ⅰ: IS31FL3763 Arduino Test Code V01B

```
#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0xC0       //IC Address
u8 PWM_H_Tab[168] =
{
  0x01,0x02,0x04,0x05,0x07,0x08,0x0A,0x0B,0X0D,0X0E,0X10,0X11, //CS01 | CS15
  0X13,0X14,0X16,0X17,0X19,0X1A,0X1C,0X1D,0X1F,0X20,0X22,0X23, //CS02 | CS16
  0X25,0X26,0X28,0X29,0X2B,0X2C,0X2E,0X2F,0X31,0X32,0X34,0X35,//CS03 | CS17
  0X37,0X38,0X3A,0X3B,0X3D,0X3E,0X40,0X41,0X43,0X44,0X46,0X47, //CS04 | CS18
  0X49,0X4A,0X4C,0X4D,0X4F,0X50,0X52,0X53,0X55,0X56,0X58,0X59, //CS05
  0X5B,0X5C,0X5E,0X5F,0X61,0X62,0X64,0X65,0X67,0X68,0X6A,0X6B, //CS06
  0X6D,0X6E,0X70,0X71,0X73,0X74,0X76,0X77,0X79,0X7A,0X7C,0X7D, //CS07
  0X7F,0X80,0X82,0X83,0X85,0X86,0X88,0X89,0X8B,0X8C,0X8E,0X8F, //CS08
  0x91,0x92,0x94,0x95,0x97,0x98,0x9A,0x9B,0X9D,0X9E,0XA0,0XA1, //CS09
  0XA3,0XA4,0XA6,0XA7,0XA9,0XAA,0XAC,0XAD,0XAF,0XB0,0XB2,0XB3, //CS10
  0XB5,0XB6,0XB8,0XB9,0XBB,0XBC,0XBE,0XBF,0XC1,0XC2,0XC4,0XC5, //CS11
  0XC7,0XC8,0XCA,0XCB,0XCD,0XCE,0XD0,0XD1,0XD3,0XD4,0XD6,0XD7, //CS12
  0XD9,0XDA,0XDC,0XDD,0XDF,0XE0,0XE2,0XE3,0XE5,0XE6,0XE8,0XE9, //CS13
  0XEB,0XEC,0XEE,0XEF,0XF1,0XF2,0XF4,0XF5,0XF7,0XF8,0XFA,0XFB  //CS14
};

u8 PWM_L_Tab[168] =
{
  0x03,0x03,0x06,0x06,0x09,0x09,0x0C,0X0C,0X0F,0X0F,0X12,0X12,//CS01 CS15
  0X15,0X15,0X18,0X18,0x1b,0x1b,0x1e,0x1e,0x21,0x21,0x24,0x24,//CS02 CS16
  0x27,0x27,0x2a,0x2a,0x2d,0x2d,0x30,0x30,0x33,0x33,0x36,0x36,//CS03 CS17
  0x39,0x39,0x3c,0x3c,0x3f,0x3f,0x42,0x42,0x45,0x45,0x48,0x48,//CS04 CS18
  0x4b,0x4b,0x4e,0x4e,0x51,0x51,0x54,0x54,0x57,0x57,0x5A,0x5A,//CS05
  0x5d,0x5d,0x60,0x60,0x63,0x63,0x66,0x66,0x69,0x69,0x6c,0x6c,//CS06
  0x6f,0x6f,0x72,0x72,0x75,0x75,0x78,0x78,0x7b,0x7b,0x7e,0x7e,//CS07
  0x81,0x81,0x84,0x84,0x87,0x87,0x8A,0x8A,0x8D,0x8D,0x90,0x90,//CS08
  0x93,0x93,0x96,0x96,0x99,0x99,0x9c,0x9c,0x9f,0x9f,0xa2,0xa2,//CS09
  0xa5,0xa5,0xa8,0xa8,0xab,0xab,0xae,0xae,0xb1,0xb1,0xb4,0xb4,//CS10
  0xb7,0xb7,0xba,0xba,0xbd,0xbd,0xc0,0xc0,0xc3,0xc3,0xc6,0xc6,//CS11
  0xc9,0xc9,0xcc,0xcc,0xcf,0xcf,0xd2,0xd2,0xd5,0xd5,0xd8,0xd8,//CS12
  0xdb,0xdb,0xde,0xde,0xe1,0xe1,0xe4,0xe4,0xe7,0xe7,0xea,0xea,//CS13
  0xed,0xed,0xf0,0xf0,0xf3,0xf3,0xf6,0xf6,0xf9,0xf9,0xfc,0xfc //CS14
};

uint8_t PWM[128]=                       //64 Step Auto Breath
{
    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,
};

uint8_t i,j,k;

void setup() {
  Wire.begin();
  Wire.setClock(400000);            //I2C 400kHz
  IS31FL3763_Breath();
}

void loop()
{

}
```

```
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 IS31FL3763_Init()
{
  u8 SL_Set;

  IS_IIC_WriteByte(Addr_GND,0xFF,0xC5);
  IS_IIC_WriteByte(Addr_GND,0xFE,0x01);

  IS_IIC_WriteByte(Addr_GND,0x60,0x01);
  IS_IIC_WriteByte(Addr_GND,0x61,0xFF);
  IS_IIC_WriteByte(Addr_GND,0x62,0x44);
  IS_IIC_WriteByte(Addr_GND,0x63,0x00);

  for(SL_Set = 0x49;SL_Set <= 0x5A;SL_Set++)
  {
    IS_IIC_WriteByte(Addr_GND,SL_Set,0xFF);
  }
}

void IS31FL3763_Breath()
{
  IS31FL3763_Init();
  while(1)
  {
    for(i = 0;i < 128;i++)
    {
     IS_IIC_WriteByte(Addr_GND,0xFF,0xC5);
     IS_IIC_WriteByte(Addr_GND,0xFE,0x00);

     for(j = 0;j < 168;j++)
     {
      IS_IIC_WriteByte(Addr_GND,PWM_H_Tab[j],PWM[i]);
     }

     IS_IIC_WriteByte(Addr_GND,0xFF,0xC5);
     IS_IIC_WriteByte(Addr_GND,0xFE,0x01);

     for(j = 0;j < 48;j++)
     {
      IS_IIC_WriteByte(Addr_GND,PWM_H_Tab[j],PWM[i]);
     }

     IS_IIC_WriteByte(Addr_GND,0xFD,0x00);

     delay(2);
    }
  }
}
```