9×8 MATRIX LED DRIVER EVALUATION BOARD GUIDE

DESCRIPTION

The IS31FL3751 is a general purpose 9×8 LED Matrix programmed via 1MHz I2C compatible interface. Each LED can be dimmed individually with 12-bit PWM data and each color LED can be dimmed with 4-bit DC scaling (Color Calibration) data which allowing 4096 steps of linear PWM dimming and 16 steps of DC current adjustable level.

Additionally each LED open and short state can be detected, IS31FL3751 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
- 10 current sinks
- 1~7 power source outputs for row scan control
- 8~10 current sink outputs for column control
- Support 8×7, 9×6, 10×n (n=1~5) matrix configurations
- Individual on/off control
- 128 global current steps
- SDB rising edge reset I2C module
- 50kHz scan frequency
- 400kHz I2C-compatible interface
- Individual open and short error detect function
- De-ghost
- QFN-20 (3mm×3mm) and SOP-20 packages
- Supply voltage range: 2.7V to 5.5V
- Support 9×8 matrix configurations
- Ultra-low operational current (500μA Typ. 700μA Max.
- Accurate color rendition
  - 2-bit global current adjust
  - 4-bit current adjust for each dot (1/16-16/16)
  - 12-bit PWM for each dot
- programmable patterns (256 gamma corrected auto dimming)
- 1MHz I2C-compatible interface
- Individual open and short error detect function
- Synchronization for multi-device application
- 180 degree phase delay operation to reduce power noise
- Spread spectrum
- 2% (typ.) 5% (max.) at 20mA bit to bit matching
- 2% (typ.) 6% (max.) at 20mA device to device matching
- De-ghost
- QFN-20 (4mm×4mm) package

QUICK START

Figure 1: Photo of IS31FL3751-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.

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31FL3751-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

PROCEDURE

The IS31FL3751 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 (OPEN=EXT CTRL) to enable the control of on board MCU (default status).
2) Short JP8 or JP7 or JP6 to select the 27kΩ/13kΩ/ 100kΩ RISET. The JP8 is default.
3) Connect the 5V DC power to VCC / GND in JP2/JP3, or plug in the USB power input to micro-USB (CON1).
4) 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 IS31FL3751 evaluation board has three display modes. Press K1 to switch configurations.

1) (Default mode) Breath Mode.
2) Spread Mode.

Note: IS31FL3751 solely controls the FxLED function on the evaluation board.

SOFTWARE SUPPORT

EXT CTRL (JP1) 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 CON4 to control the IS31FL3751 LED driver.

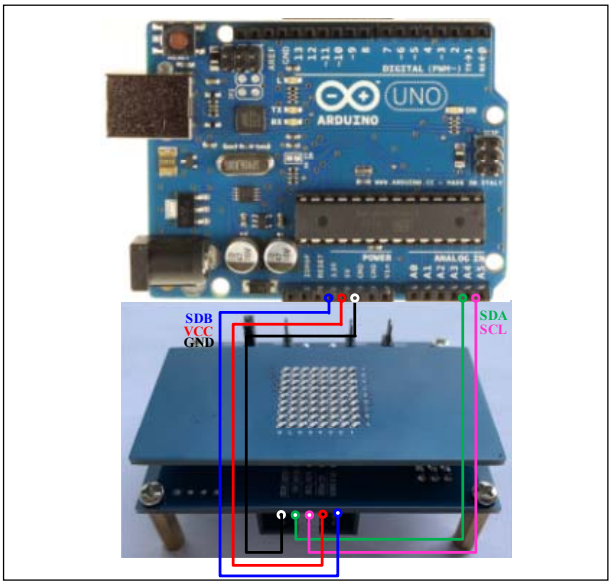

Figure 2: Photo of Arduino UNO connected to Evaluation Board

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 IS31FL3751 test firmware (sketch) from the Lumissil website http://www.lumissil.com/products/led-driver/fxled.

1) Open EXT CTRL (JP1).
2) Connect the 5 pins from Arduino board to IS31FL3751 EVB:
   a) Arduino 5V pin to IS31FL3751 EVB VCC.
   b) Arduino GND to IS31FL3751 EVB GND.
   c) Arduino SDA (A4) to IS31FL3751 EVB SDA.
   d) Arduino SCL (A5) to IS31FL3751 EVB SCL.
   e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3751 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 IS31FL3751.

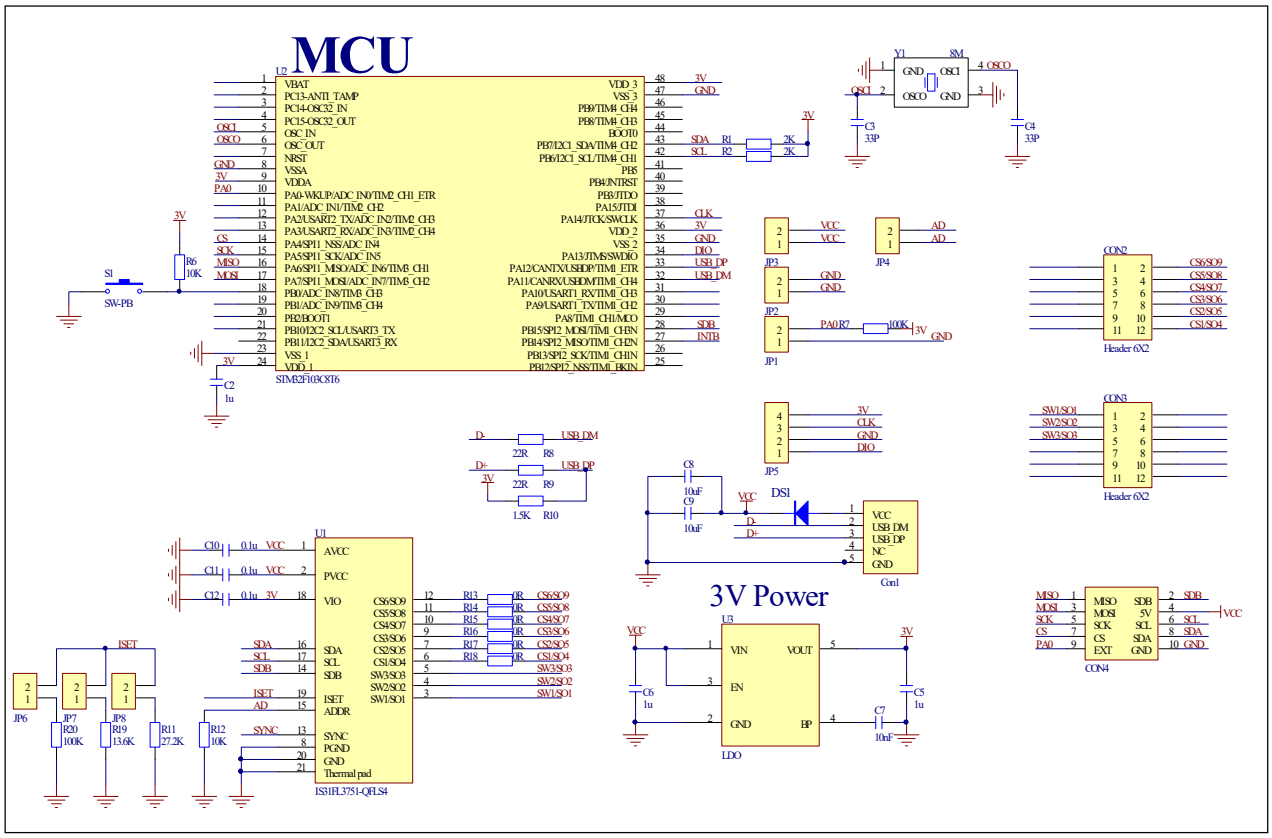

Figure 3: IS31FL3751 Application Schematic

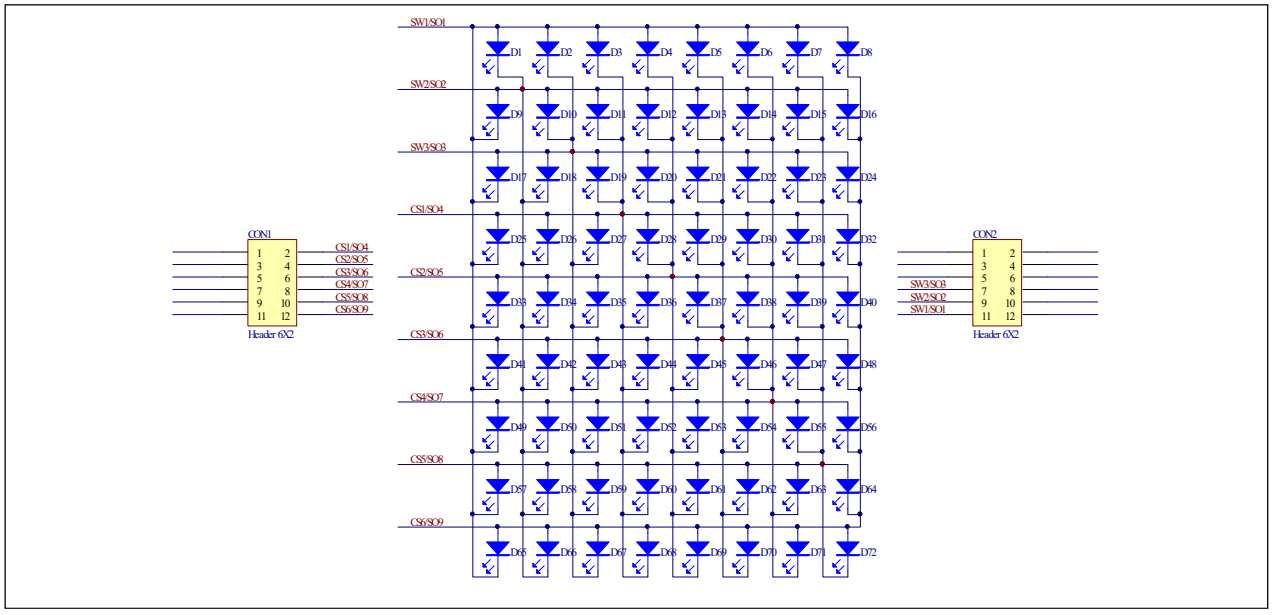

Figure 4: IS31FL3751 LED 8X9 Schematic

BILL OF MATERIALS

IS31FL3751

Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U1	Matrix LED Driver	1	Lumissil	IS31FL3751
MCU	U2	Microcontroller	1	STM	STM32F103C8T6
LDO	U3	3.0V LDO	1	SGMICRO	SGM2019-3.0YN5G
Crystal	Y1	Crystal, 8MHz	1	HLX	HC-49S
Diode	D1	Diode, SMD	1	DIODES	DFLS240
Resistor	R1,R2	RES,2k,1/10W,±5%,SMD	2	Yageo	RC0603JR-072KL
Resistor	R6,R12	RES,10k,1/10W,±5%,SMD	2	Yageo	RC0603JR-0710KL
Resistor	R7,R20	RES,100k,1/10W,±5%,SMD	2	Yageo	RC0603JR-07100KL
Resistor	R8,R9	RES,22R,1/10W,±5%,SMD	2	Yageo	RC0603JR-0722RL
Resistor	R10	RES,1.5k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071K5L
Resistor	R11	RES,27k,1/10W,±5%,SMD	1	Yageo	RC0603JR-0727KL
Resistor	R13~R18	RES,0R,1/10W,±5%,SMD	6	Yageo	RC0603JR-070RL
Resistor	R19	RES,13k,1/10W,±5%,SMD	1	Yageo	RC0603JR-0713KL
Capacitor	C2,C5,C6	CAP, 1μF,16V,±10%,SMD	3	Yageo	CC0603KRX7R7BB105
Capacitor	C3,C4	CAP,33pF,50V,±5%,SMD	2	Yageo	CQ0603JRNPO9BN360
Capacitor	C7	CAP,10nF,16V,±10%,SMD	1	Yageo	CC0603KPX7R7BB103
Capacitor	C8,C9	CAP,10μF,16V,±20%,SMD	2	Yageo	CC0805KKX7R7BB106
Capacitor	C10,C11, C13	CAP,100nF,16V,±20%,SMD	3	Yageo	CC0603MRX7R7BB104
Button	S1	Button SMD	1		

Bill of Materials, refer to Figure 3 above.

FxLED 8×9 ARRAY

Name	Symbol	Description	Qty	Supplier	Part No.
LED	D1~D72	LED Blue, SMD	72	Everlight	19-217/BHC-ZL1M2RY/3T

Bill of Materials, refer to Figure 4 above.

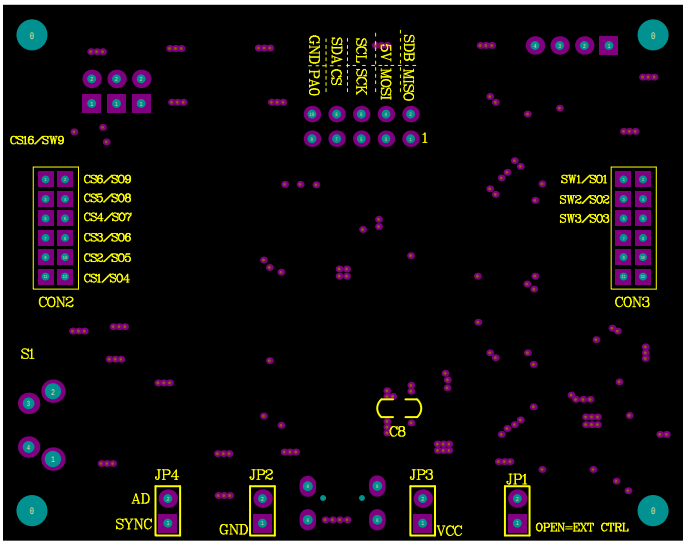

Figure 4: Board Component Placement Guide - Top Layer

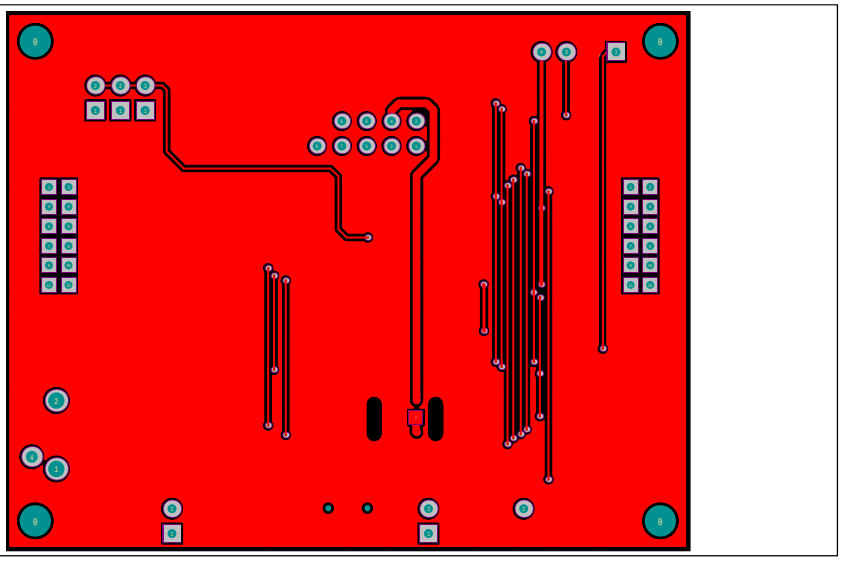

Figure 5: Board PCB Layout - Top Layer

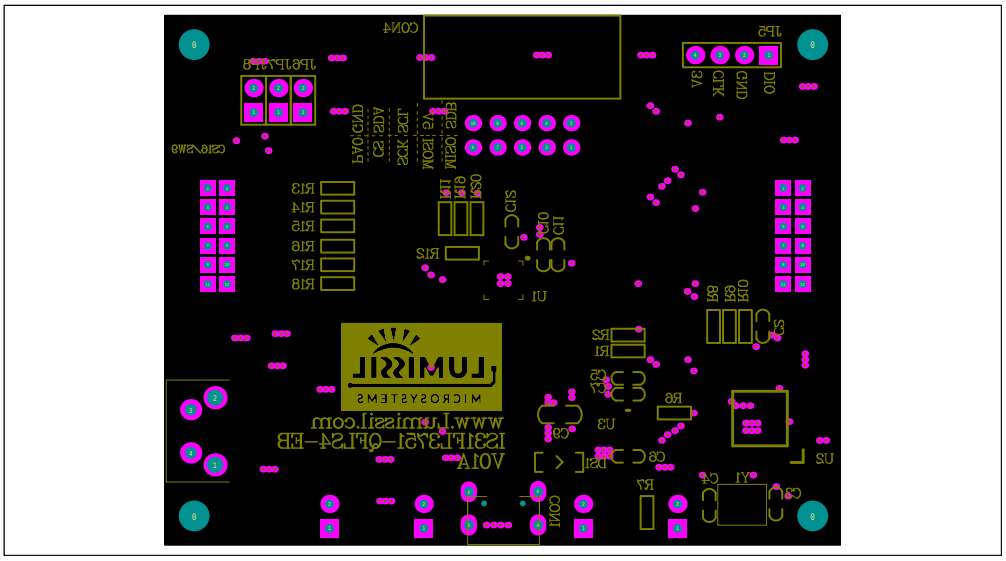

Figure 6: Board Component Placement Guide - Bottom Layer

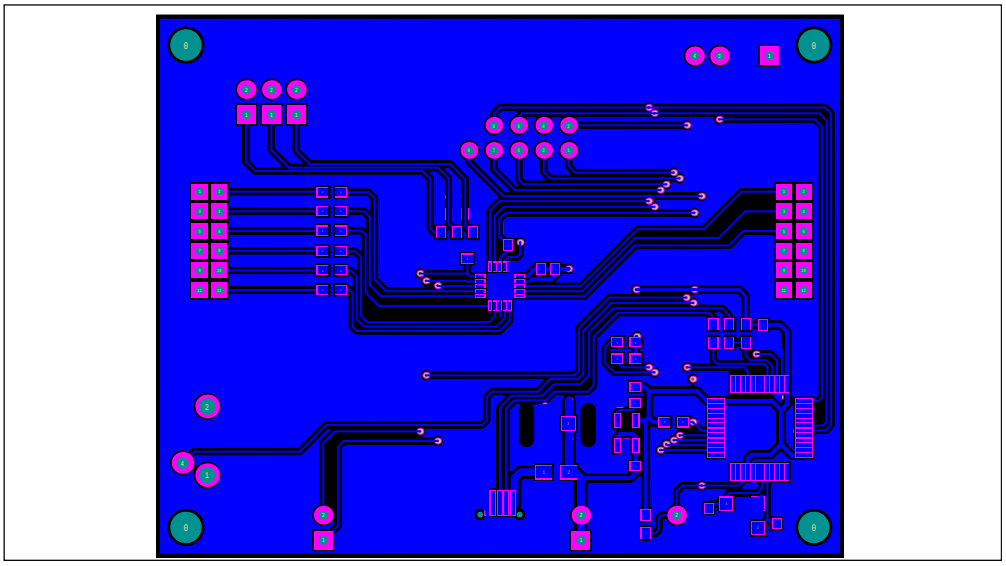

Figure 7: Board PCB Layout - Bottom Layer

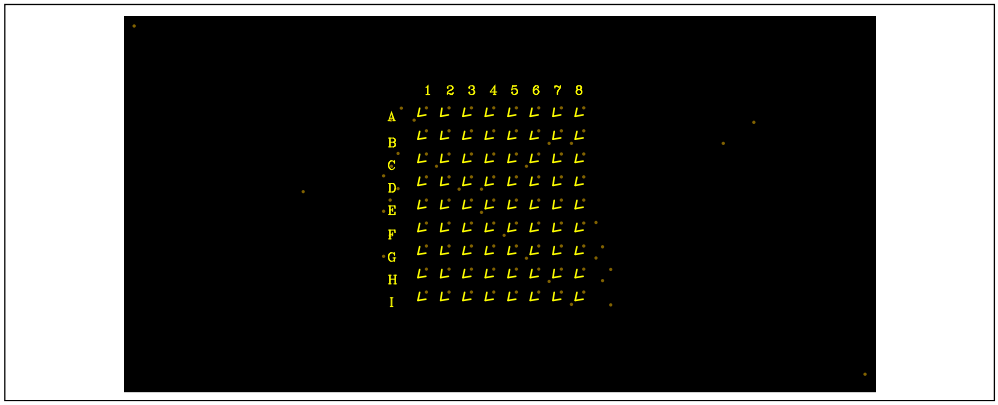

Figure 8: Board Component Placement Guide - Top Layer

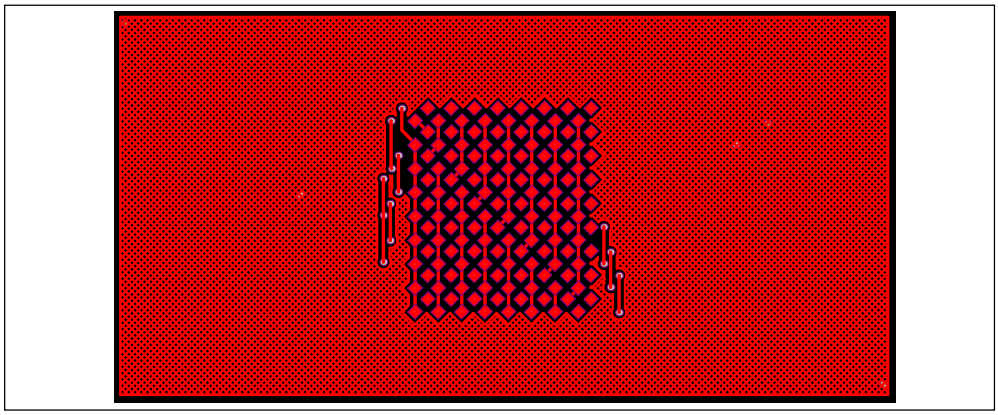

Figure 9: Board PCB Layout - Top Layer

Figure 10: Board Component Placement Guide - Bottom Layer

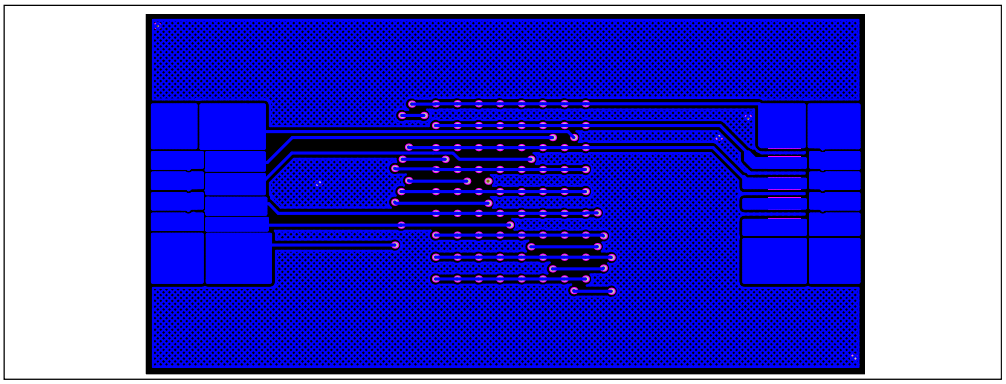

Figure 11: Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Data
A	Initial Release	2021.04.29

APPENDIX Ⅰ: IS31FL3751 Arduino Test Code V01A

```
#include<Wire.h>
#include<avr/pgmspace.h>

#define Addr_GND 0xB8//3751 address

void setup() {
  // put your setup code here, to run once:
  Wire.begin();
  Wire.setClock(400000);//I2C 400kHz
}

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

void loop() {
  // put your main code here, to run repeatedly:
  mainloop();
}
void Init3751(void)
{
  int i,j;
  IS_IIC_WriteByte(Addr_GND,0xC0,0x00);//shutdown
  for(i=0X00;i<=0X8F;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0x00);//PWM
  }
  for(i=0X90;i<=0XB3;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0xFF);//SL
  }
  for(i=0XB4;i<=0XBC;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0x00);//PWM
  }
  IS_IIC_WriteByte(Addr_GND,0xC0,0x01);//normal operation 9x8 mode
  IS_IIC_WriteByte(Addr_GND,0xC1,0x00);//GCC set 4/4
  IS_IIC_WriteByte(Addr_GND,0xC2,0x88);//phase delay enable ,8 bit PWM mode
  IS_IIC_WriteByte(Addr_GND,0xC3,0x10);//Enable deghost,OUT pin pull to PVCC-0.8V. if disable this function,ICC can safe about 50uA.
}

void Breath_3751(void)
{
  int i;
    IS_IIC_WriteByte(Addr_GND,0xC2,0x80);//12 bit PWM mode
   IS_IIC_WriteByte(Addr_GND,0xB4,0xFF);//ABME
    for(i=0XB4;i<=0XBC;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0xFF);//ABME
  }
  IS_IIC_WriteByte(Addr_GND,0xBC,0xFF);//ABME
  IS_IIC_WriteByte(Addr_GND,0xC4,0x00);//T1&T2
  IS_IIC_WriteByte(Addr_GND,0xC5,0x00);//T3&T4
  IS_IIC_WriteByte(Addr_GND,0xC6,0x00);//Endless loop times
  IS_IIC_WriteByte(Addr_GND,0xC7,0x00);//Endless loop times
```

```
    IS_IIC_WriteByte(Addr_GND,0xC8,0x00);//update time register
    IS_IIC_WriteByte(Addr_GND,0xC0,0x09);//Breath enable
}

void mainloop(void)//
{
    int i;
    Init3751();
    Breath_3751();// I2C write only 1 time
    while(1)
    {};
}
```