IS31FL3293 3-CHANNEL FUN LED DRIVER

DESCRIPTION

The IS31FL3293 is a 3 LED current sink LED driver programmed via 1MHz I2C compatible interface. Each LED can be dimmed individually with 4096 steps 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.

The IS31FL3293 operates from 2.7V to 5.5V and features a very low shutdown and operational current.

The IS31FL3293 can operate in either "Current Level & PWM mode" or "Pattern" mode. In Current Level & PWM mode, the output current of each output is independently programmed and controlled in 256 steps to achieve color mixing and the PWM duty cycle of each output is also independently programmed and controlled in 4096 steps to simplify color mixing or for smoothly diming control. In Pattern mode, the timing characteristics for RGB channels output can be individually adjusted to maintain a pre-established pattern sequence without requiring any additional MCU interaction, thus saving valuable system resources.

IS31FL3293 is available in UTQFN-9 (1.5mm × 1.5mm) package. It operates from 2.7V to 5.5V over the temperature range of -40°C to +125°C.

FEATURES

- Supply voltage range: 2.7V to 5.5V
- 3 current sinks, I_{OUT}= 20mA (Max.)
- Ultra-low operational current (90µA Typ. at V_{CC}= 3.6V, all LED off)
- Accurate color rendition
  - 12-bit PWM/channel
  - 8-bit Current Level/channel
  - 6-bit global DC current adjust
- SDB rising edge reset I2C module
- 1MHz I2C-compatible interface
- ±5% accuracy and mismatch @I_{OUT}= 20mA and I_{OUT}= 3mA
- Auto breath function:
  - Auto breath pattern for 3 channels and each channel can quit the pattern and control by CL&PWM
  - Fade in/ fade out time length max value up to 9.96s.
  - Single Pulse/Multi pulse/manual control modes for auto breath
  - 3 color pre-configure pattern registers for color breath
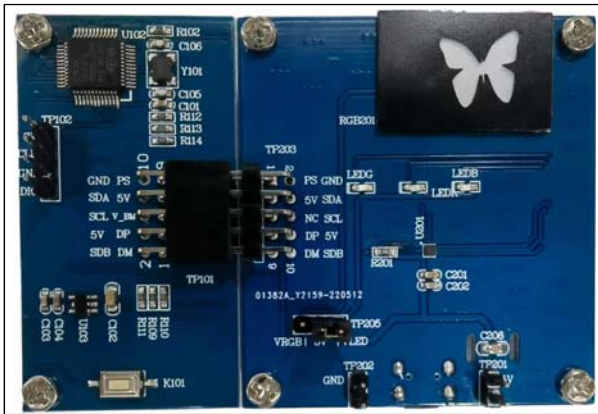- UTQFN-9 (1.5mm × 1.5mm) package

QUICK START

Figure 1: Photo of IS31FL3293-UTLS4 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
IS31FL3293-UTLS4-EB	-40°C to +125°C, Industrial	UTQFN-9, 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.

IS31FL3293 3-CHANNEL FUN LED DRIVER

PROCEDURE

The IS31FL3293 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) Connect the MCU board's TP101 to the IS31FL3293 board's TP203 to enable the control of MCU (default status).
2) Connect the Variable power supply to VIN/GND, or plug in the USB power input to micro-USB.
3) Short 5V and VLED in TP205 to enable the single color LEDs, or short 5V and VRGB in TP205 to enable the RGB LED.
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 IS31FL3293 evaluation board has 4 display modes. Press MODE (K101) button to switch configurations.

1) (Default mode) Run in PWM & Current Level Mode
Short connect 5V and VLED of TP205. First loop, start left to right LED open by auto breath, when all LED open, there will start right to left LED close by auto breath. Second loop, start right to left LED open, when LED all open, start left to right LED close. When second loop over start to run first loop.

2) Run in PWM & Current Level Mode
Short connect 5V and VLED of TP205. First loop, start left to right single LED auto breath open and auto breath close. Second loop, start right to left single LED auto breath open and auto breath close. When second loop over start to run first loop.

3) Run in Current Level Mode
Short connect 5V and VLED of TP205. All LED at the same time fast auto breath open and slow auto breath close.

4) Run in Pattern Mode
Short connect 5V and VRGB of TP205. There will running 3 color of RGB, and 3 color by auto breath open and close. Color 1 is red, color 2 is purple, color 3 is light blue.

5) Disconnect TP101 from TP203 (remove the MCU control board), the IS31FL3293 board will continue running the Pattern Mode.

6) If a variable power supply is connected to TP201 and TP202, lower the voltage to 2.7V to verify continued operation under low voltage condition.

Figure 2: Photo of IS31FL3293 Board disconnected from MCU board

Note: IS31FL3293 solely controls the FxLED function on the evaluation board.

SOFTWARE SUPPORT

The MCU board's TP101 interconnects with the IS31FL3293 board's TP203. If TP101 is disconnected from TP203, the MCU to IS31FL3293 communication will be removed. The I2C pins are floated and SDB pin is pulled high by R201. An external I2C and SDB signal can be connected to TP203 to externally control the IS31FL3293 LED driver. Short TP205's 5V to VLED to enable the individual LEDs (LEDG/LEDR/LEDB), or short 5V to VRGB to enable the RGB Butterfly.

The steps listed below are an example for using the Arduino as 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 IS31FL3293 test firmware (sketch) from the Lumissil website http://www.lumissil.com/products/led-driver/fxled.
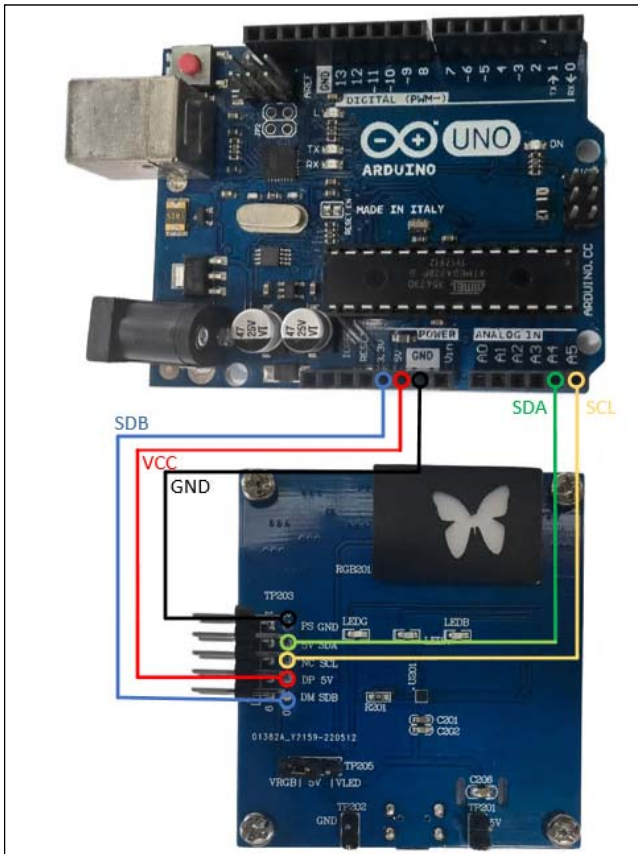
Figure 3: Photo of Arduino UNO connected to IS31FL3293 Board

1) TP101 disconnect from TP203 (Remove MCU control board)
2) Connect the 5 pins from Arduino board to the IS31FL3293 Board:
   a) Arduino 5V pin to IS31FL3293 board VCC.
   b) Arduino GND to IS31FL3293 board GND.
   c) Arduino SDA (A4) to IS31FL3293 board SDA.
   d) Arduino SCL (A5) to IS31FL3293 board SCL.
   e) (Optional, SDB has a weak pull-up to 5V by R201) If Arduino uses a 3.3V MCU VCC, connect 3.3V to IS31FL3293 board SDB (TP203), if Arduino uses a 5.0V MCU VCC, connect 5.0V or 3.3V to IS31FL3293 board SDB (TP203).
   (Arduino UNO MCU VCC is 5V, so SDB can be 5V or 3.3V).

Use the test code in appendix Ⅰ or download the test firmware (sketch) from the Lumissil website, and copy the code to Arduino IDE, compile and upload to Arduino.

3) Run the Arduino code which will program the IS31FL3293 to cycle through color patterns, there is no button control.

4) Short 5V and VLED in TP205 to enable the single color LEDs (LEDG/LEDR/LEDB), or short 5V and VRGB in TP205 to enable the RGB LED.

Please refer to the datasheet to get more information about IS31FL3293.
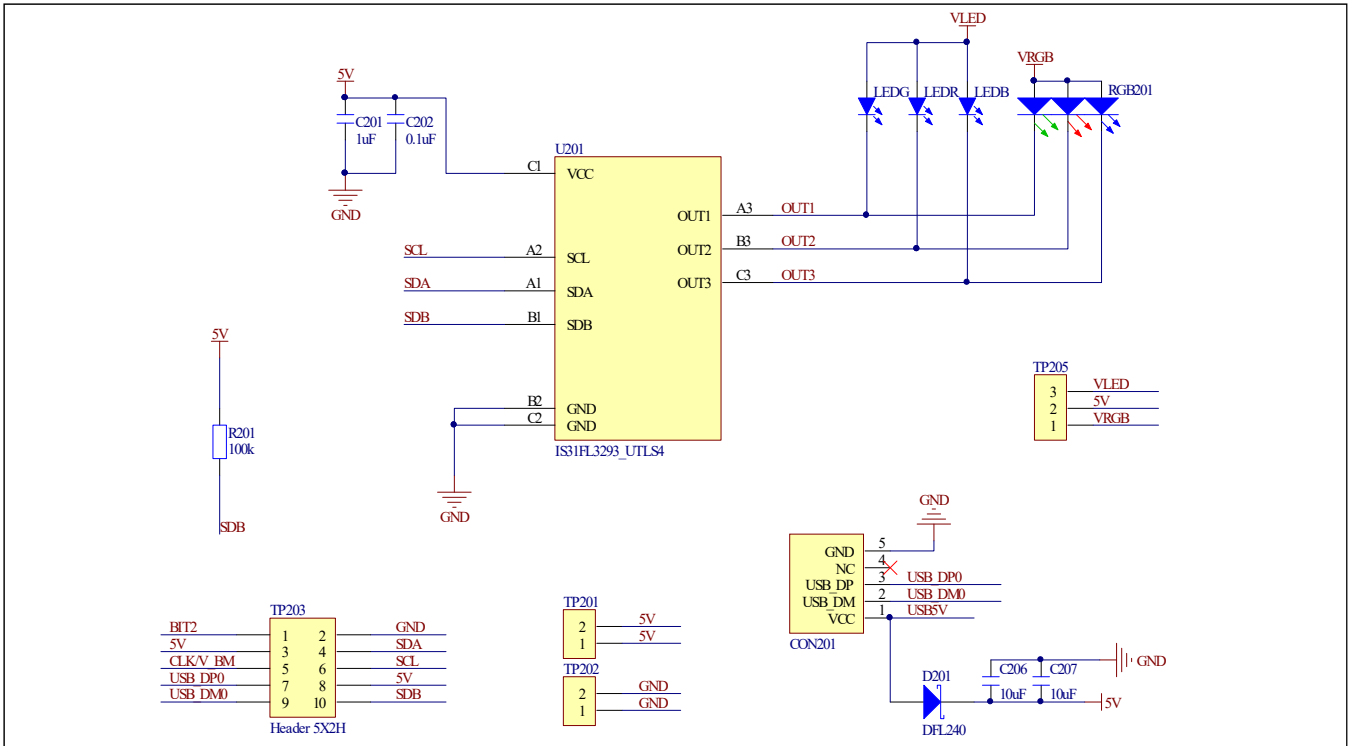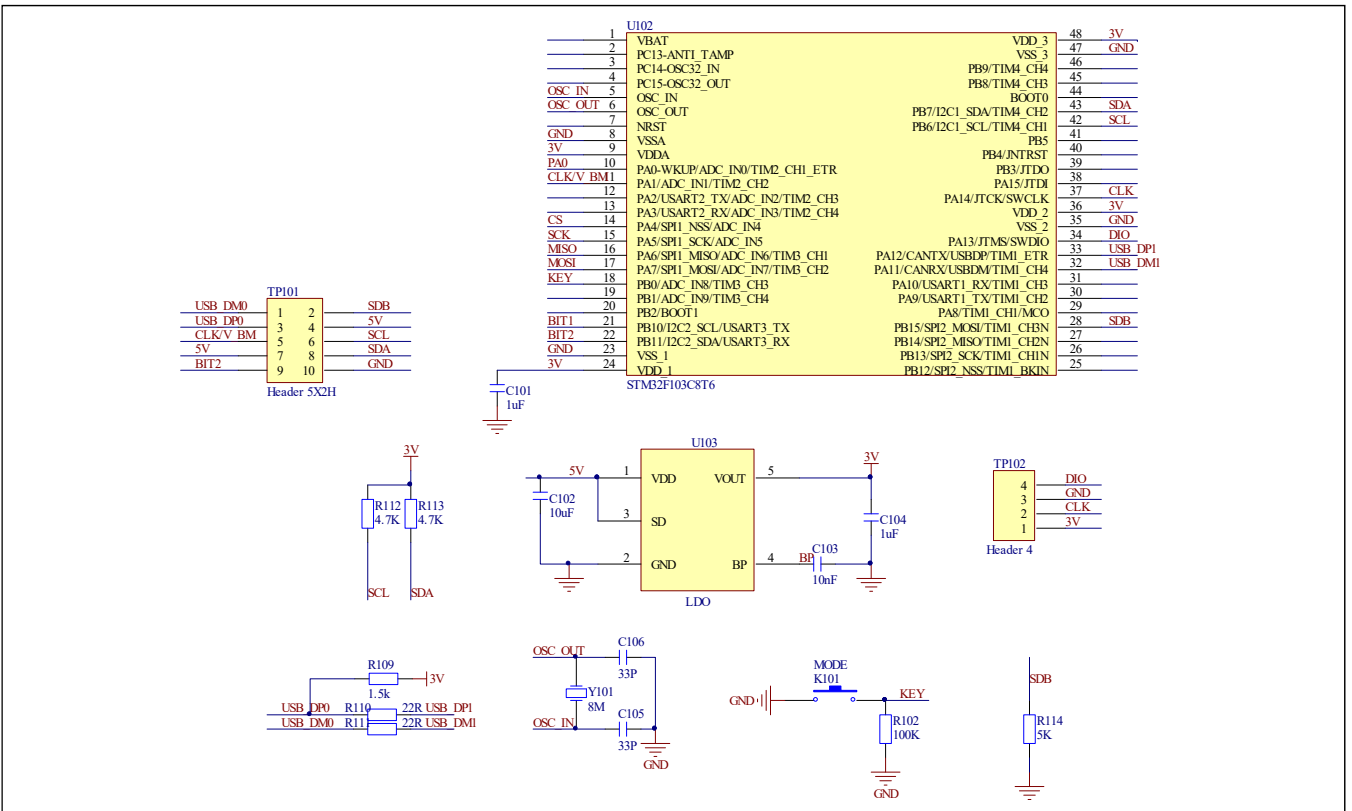
Figure 4: IS31FL3293 Schematic

Figure 5: MCU Schematic

BILL OF MATERIALS

IS31FL3293

Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U201	3CH FxLED Driver	1	Lumissil	IS31FL3293
Diode	D201	Diode, SMD	1	DIODES	DFLS240
LED	LEDB	Diode, LED Blue, SMD	1	Everlight	19-217/BHC-AN1P2/3T
LED	LEDG	Diode, LED Green, SMD	1	Everlight	19-217/GHC-YR1S2/3T
LED	LEDR	Diode, LED Red, SMD	1	Everlight	19-217/R6C-P1Q2/3T
LED	RGB201	Diode, LED RGB, SMD	1	Everlight	99-235/RSGBB7C-A22/2D or 99-235/RGBC/TR8
Resistor	R201	RES,100k,1/10W,±5%,SMD	1	Yageo	RC0603JR-07100KL
Capacitor	C201	CAP, 1µF,16V,±10%,SMD	1	Yageo	CC0603KRX7R7BB105
Capacitor	C202	CAP,100nF,16V,±20%,SMD	1	Yageo	CC0603MRX7R7BB104
Capacitor	C206,C207	CAP,10µF,16V,±20%,SMD	2	Yageo	CC0805MRX5R7BB106
Header	TP201, TP202	VCC and GND Jumper	1		
Header	TP203	5×2 Connection Jumper	1		
Header	TP205	RGB/LEDs select Jumper	1		
Diffuser		RGB Butterfly	1		Proprietary

Bill of Materials, refer to Figure 4 above.

STM32F103C8T6

Name	Symbol	Description	Qty	Supplier	Part No.
MCU	U102	Microcontroller	1	STM	STM32F103C8T6
LDO	U103	3.0V LDO	1	SGMICRO	SGM2019-3.0YN5G
Crystal	Y101	Crystal, 8MHz	1	HLX	HC-49S
Resistor	R102	RES,100k,1/10W,±5%,SMD	1	Yageo	RC0603JR-07100KL
Resistor	R109	RES,1.5k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071K5L
Resistor	R110,R111	RES,22R,1/10W,±5%,SMD	2	Yageo	RC0603JR-0722RL
Resistor	R112,R113	RES,4.7k,1/10W,±5%,SMD	2	Yageo	RC0603JR-074K7L
Resistor	R114	RES,5k,1/10W,±5%,SMD	1	Yageo	RC0603JR-0705KL
Capacitor	C101,C104	CAP, 1µF,16V,±10%,SMD	2	Yageo	CC0603KRX7R7BB105
Capacitor	C102	CAP,10µF,16V,±20%,SMD	1	Yageo	CC0603MRX5R7BB106
Capacitor	C103	CAP,10nF,16V,±10%,SMD	1	Yageo	CC0603KPX7R7BB103
Capacitor	C105,C106	CAP,33pF,50V,±5%,SMD	2	Yageo	CQ0603JRNPO9BN360
Header	TP101	5×2 Connection Jumper	1		
Button	K101	Button SMD	1		

Bill of Materials, refer to Figure 5 above.
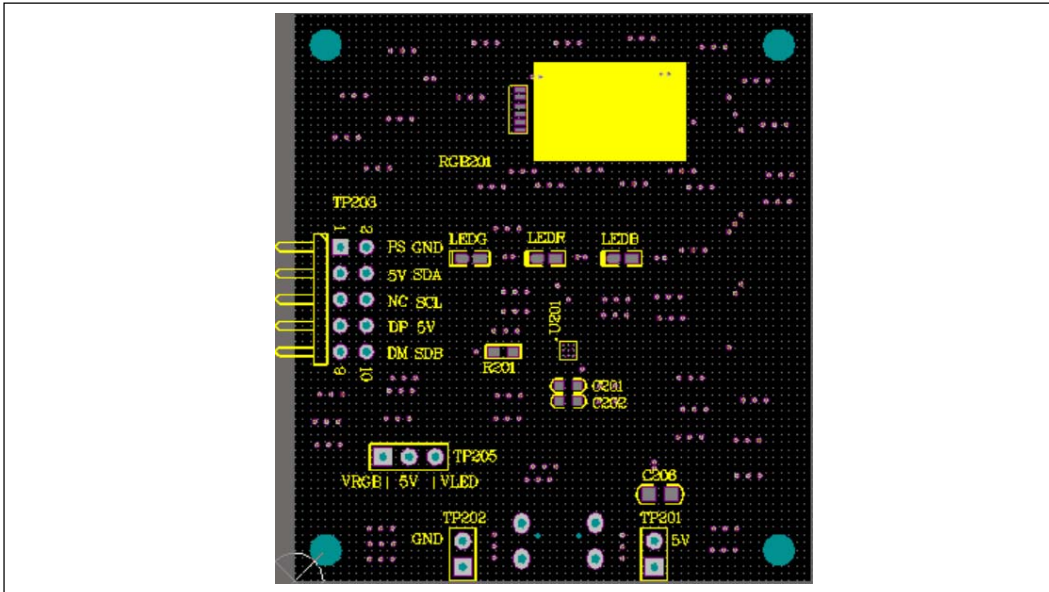
Figure 6: Board Component Placement Guide - Top Layer
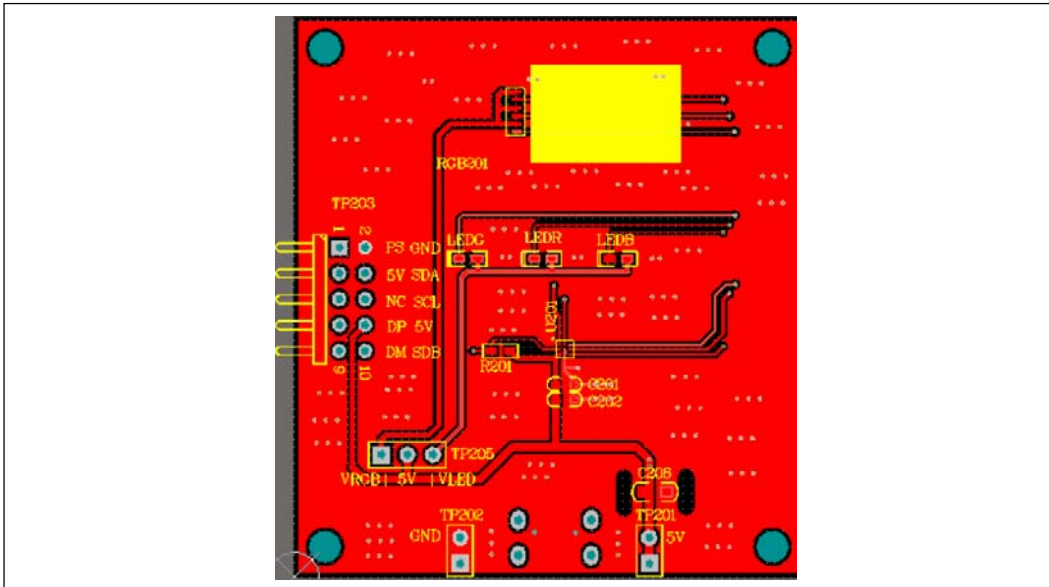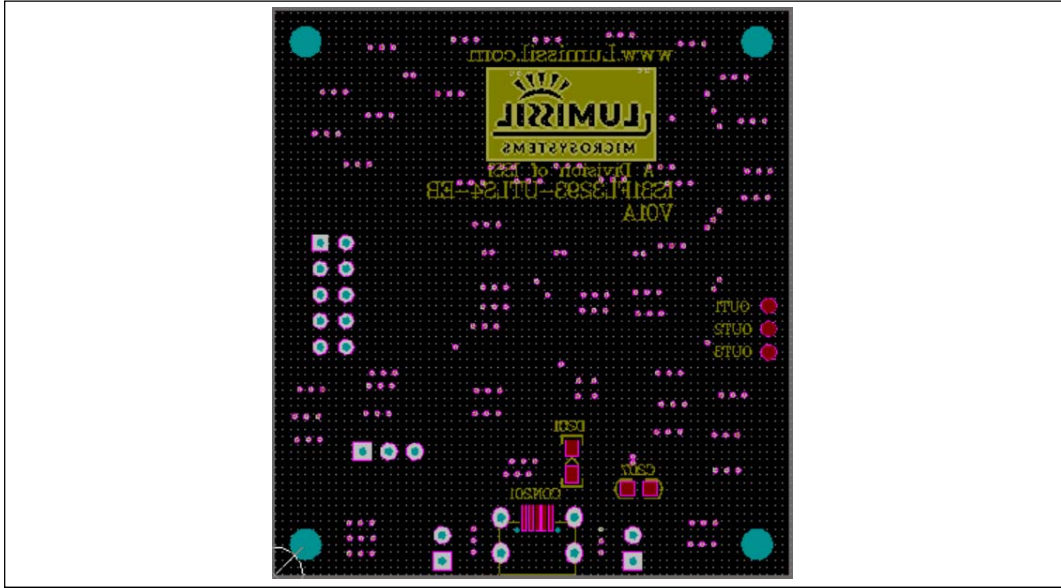

Figure 7: Board PCB Layout - Top Layer

Figure 8: Board Component Placement Guide - Bottom Layer
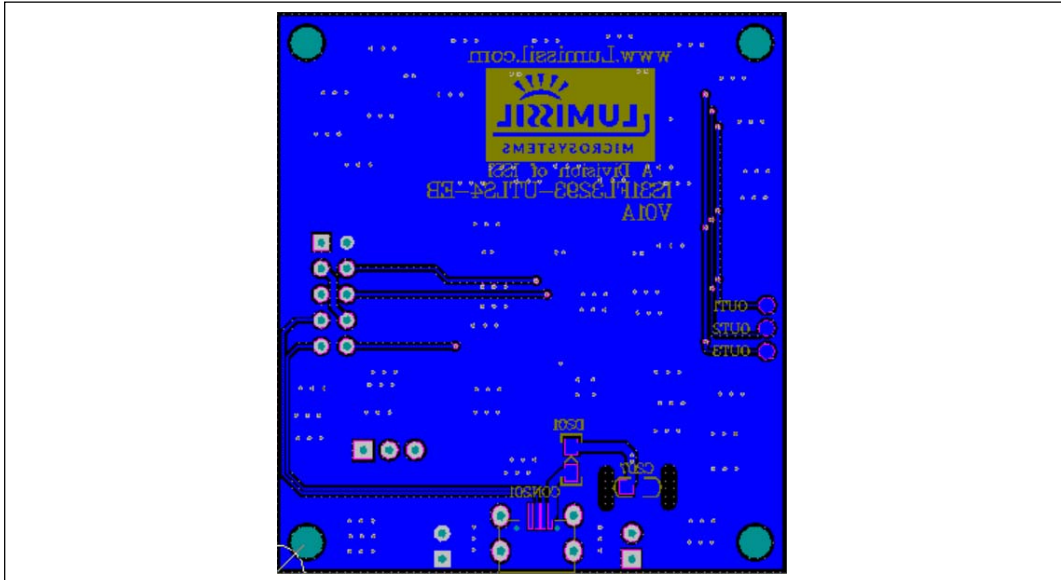
Figure 9: Board PCB Layout - Bottom Layer
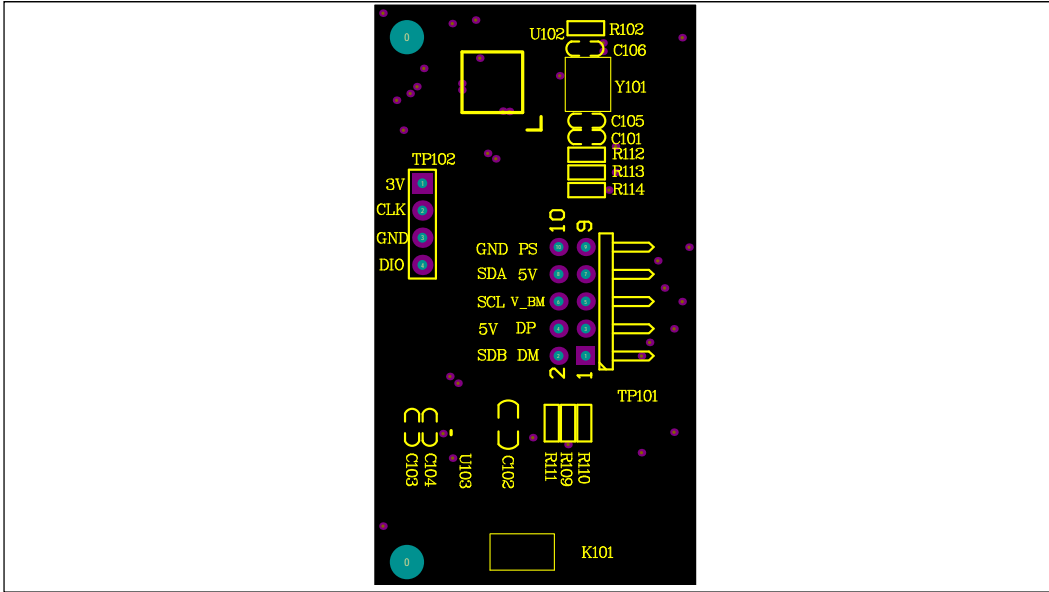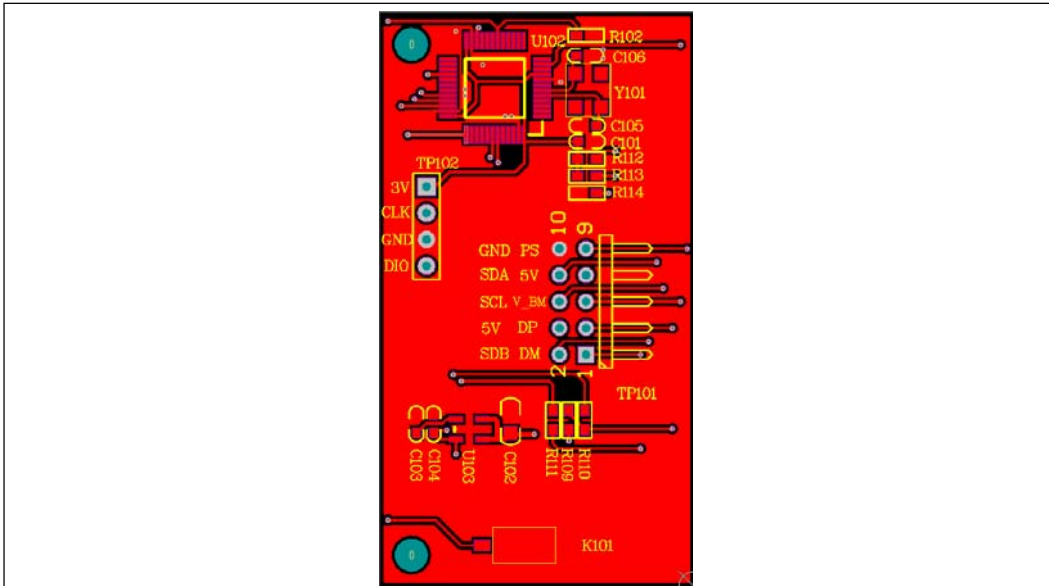
Figure 10: Board Component Placement Guide - Top Layer

Figure 11: Board PCB Layout - Top Layer
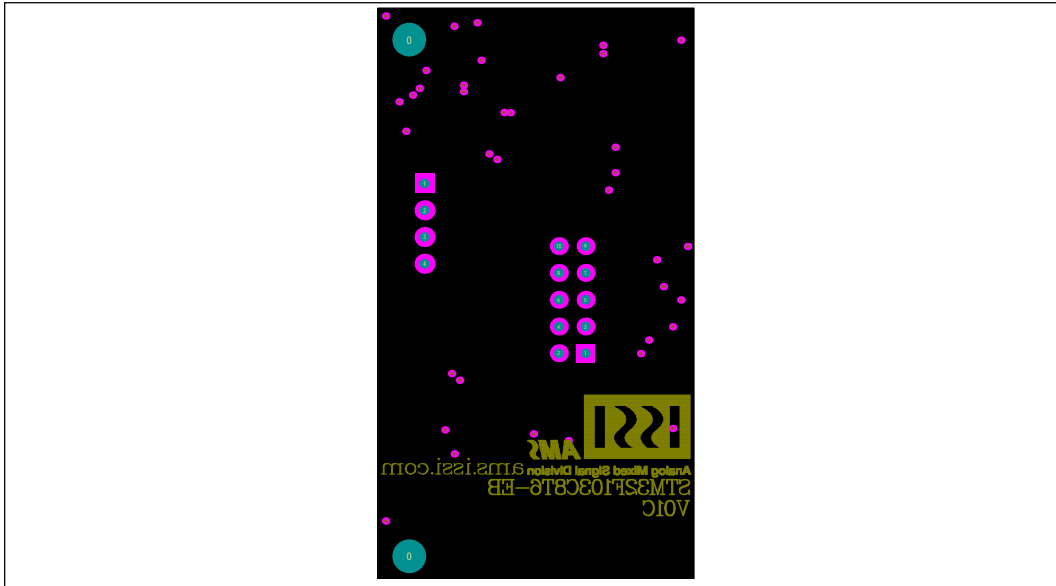
Figure 12: Board Component Placement Guide - Bottom Layer
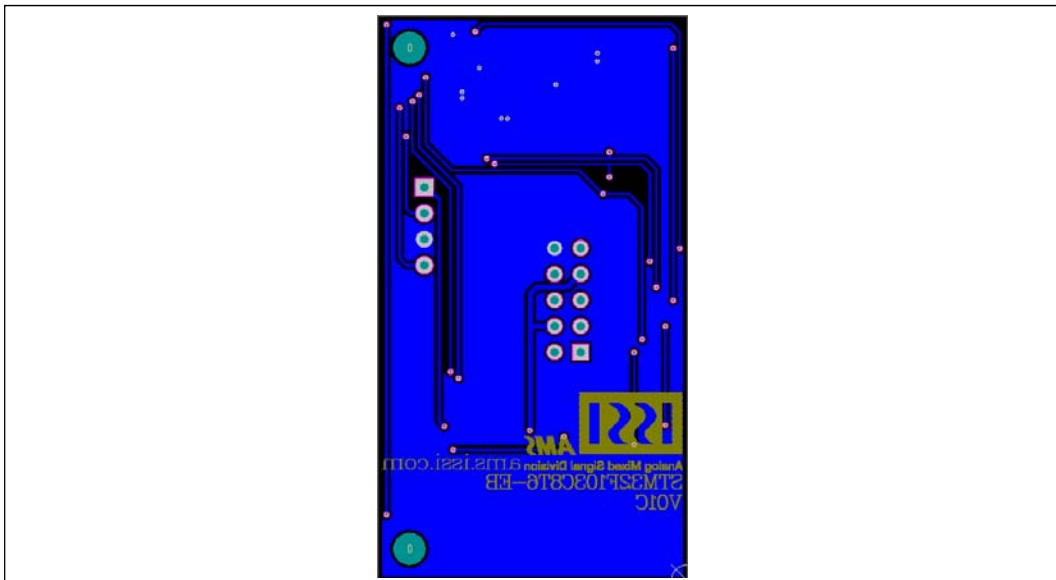
Figure 13: Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Data
A	Initial release	2022.09.22

APPENDIX Ⅰ: IS31FL3293 Arduino Test Code V01A

```
#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0xD8

uint8_t i,j;

void setup() {
  Wire.begin();
  Wire.setClock(400000);                    //I2C 400kHz
  IS31FL3293_PWM_Breath_Mode();
}

void loop()
{

}

void IS_IIC_WriteByte(uint8_t Dev_Add,uint8_t Reg_Add,uint8_t Reg_Dat)
{
  Wire.beginTransmission(Dev_Add/2); // transmit to device IS31FL373x
  Wire.write(Reg_Add); // sends regaddress
  Wire.write(Reg_Dat); // sends regaddress
  Wire.endTransmission(); // stop transmitting
}

void IS31FL3293_PWM_Breath_Mode()
{
  //1--Reset All Register
  IS_IIC_WriteByte(Addr_GND,0x3F,0xC5);

  //2--Init IC
  IS_IIC_WriteByte(Addr_GND,0x01,0x71);
  IS_IIC_WriteByte(Addr_GND,0x02,0x15);
  IS_IIC_WriteByte(Addr_GND,0x03,0x3F);

  //3--Main Function Code
  //(1)--Set Color1 Value
  IS_IIC_WriteByte(Addr_GND,0x10,0);        //Set OUT1
  IS_IIC_WriteByte(Addr_GND,0x11,139);      //Set OUT2
  IS_IIC_WriteByte(Addr_GND,0x12,0);        //Set OUT3

  //(2)--Set Color2 Value
  IS_IIC_WriteByte(Addr_GND,0x13,0);        //Set OUT1
  IS_IIC_WriteByte(Addr_GND,0x14,255);      //Set OUT2
  IS_IIC_WriteByte(Addr_GND,0x15,255);      //Set OUT3

  //(3)--Set Color3 Value
  IS_IIC_WriteByte(Addr_GND,0x16,255);      //Set OUT1
  IS_IIC_WriteByte(Addr_GND,0x17,0);        //Set OUT2
  IS_IIC_WriteByte(Addr_GND,0x18,255);      //Set OUT3

  //(4)--Set Pattern Time
  IS_IIC_WriteByte(Addr_GND,0x20,0x44);     //Set Ts & T1
  IS_IIC_WriteByte(Addr_GND,0x21,0x44);     //Set T2 & T3
  IS_IIC_WriteByte(Addr_GND,0x22,0x44);     //Set Tp & T4

  //(5)--Enable Colorx
  IS_IIC_WriteByte(Addr_GND,0x23,0xFF);     //ALL Color Enable

  //(6)--Loop Times Setup
  IS_IIC_WriteByte(Addr_GND,0x24,0x15);     //Set Color Loop tims
  IS_IIC_WriteByte(Addr_GND,0x25,0x00);     //Set Color1,Color2,Color3 Loop tims
  IS_IIC_WriteByte(Addr_GND,0x26,0x80);     //Set Pattern Loop tims

  //(7)--Update
  IS_IIC_WriteByte(Addr_GND,0x27,0xC5);     //Update Color Value
  IS_IIC_WriteByte(Addr_GND,0x29,0xC5);     //Update Loop time set
}
```