4-LED LED DRIVER

DESCRIPTION

The IS31FL3294 is a 4 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.

FEATURES

- Supply voltage range: 2.7V to 5.5V
- 4 current sinks, I_{OUT}= 40mA (Max.)
- Ultra-low operational current (200μA Typ. at V_{CC}=3.6V)
  - Power-saving mode: 1μA (Typ.) with SDB high and all LEDs off
- Accurate color rendition
  - 12-bit/8+4-bit PWM/channel
  - 8-bit correction/channel
  - 6-bit global current adjust
- SDB rising edge reset I2C module
- 1MHz I2C-compatible interface
- Auto breath function
  1) 3 patterns auto breath
  2) Fade IN/ Fade OUT time up to 8s
  3) Single Pulse/Multi pulse/Manual control modes for auto breath
  4) 3 color pre-configure registers for color breath
- UTQFN-12 (2mm×2mm) package
- RoHS & Halogen-Free Compliance
- TSCA Compliance

QUICK START

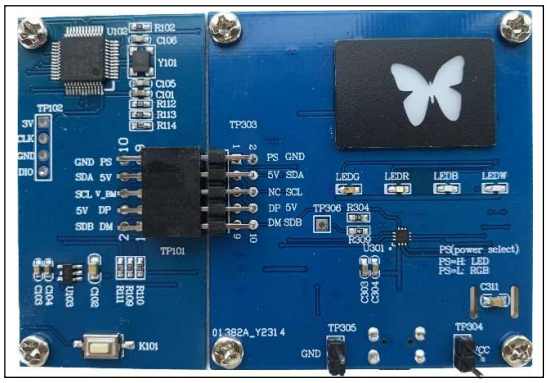

Figure 1: Photo of IS31FL3294 Evaluation Board

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 IS31FL3294 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 IS31FL3294 board's TP303 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) 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
IS31FL3294-UTLS4-EB	-40°C ~ +125°C (Industrial)	UTQFN-12, 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 IS31FL3294 evaluation board has five display modes. Press K1 to switch configurations.

1) RGB Mode
2) 3 Pattern Mode
3) Current Level Mode
4) PWM Mode

Note: IS31FL3294 solely controls the FxLED function on the evaluation board.

SOFTWARE CONTROL

The MCU board's TP101 interconnects with the IS31FL3294 board's TP303. If TP101 is disconnected from TP303, The I2C pins are floated and SDB pin is pulled down by R304. An external I2C and SDB signal can be connected to TP303 to externally control the IS31FL3294 LED driver.

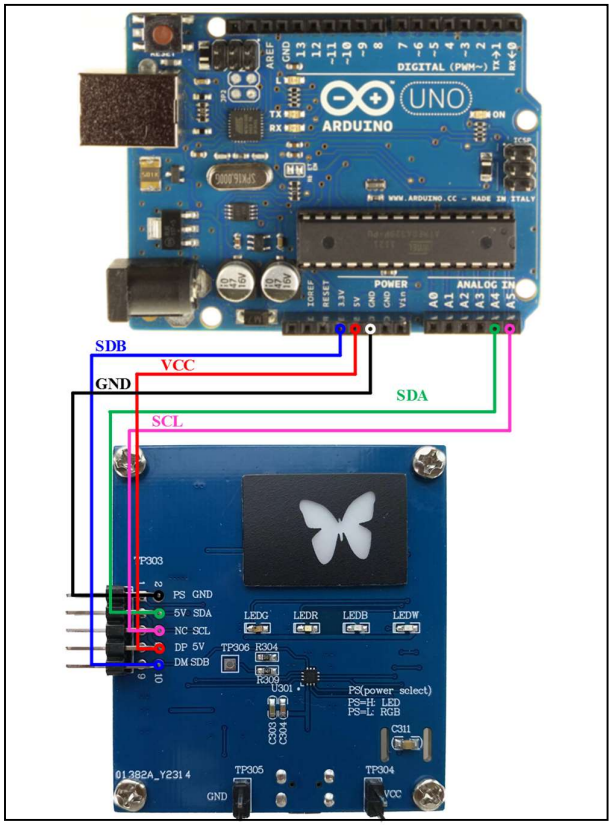

Figure 2: Photo of Arduino UNO connected to Evaluation Board

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 IS31FL3294 test firmware (sketch) from the Lumissil website http://www.lumissil.com/products/led-driver/fxled.

1) TP101 disconnect from TP303 (Remove MCU control board)
2) Connect the 5 pins from Arduino board to IS31FL3294 EVB:
   a) Arduino 5V pin to IS31FL3294 EVB VCC.
   b) Arduino GND to IS31FL3294 EVB GND.
   c) Arduino SDA (A4) to IS31FL3294 EVB SDA.
   d) Arduino SCL (A5) to IS31FL3294 EVB SCL.
   e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3294 EVB SDB, if Arduino use 5.0V MCU VCC, connect 5.0V 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 which will program the IS31FL3294 to cycle through color patterns, there is no button control.

Please refer to the datasheet to get more information about IS31FL3294.

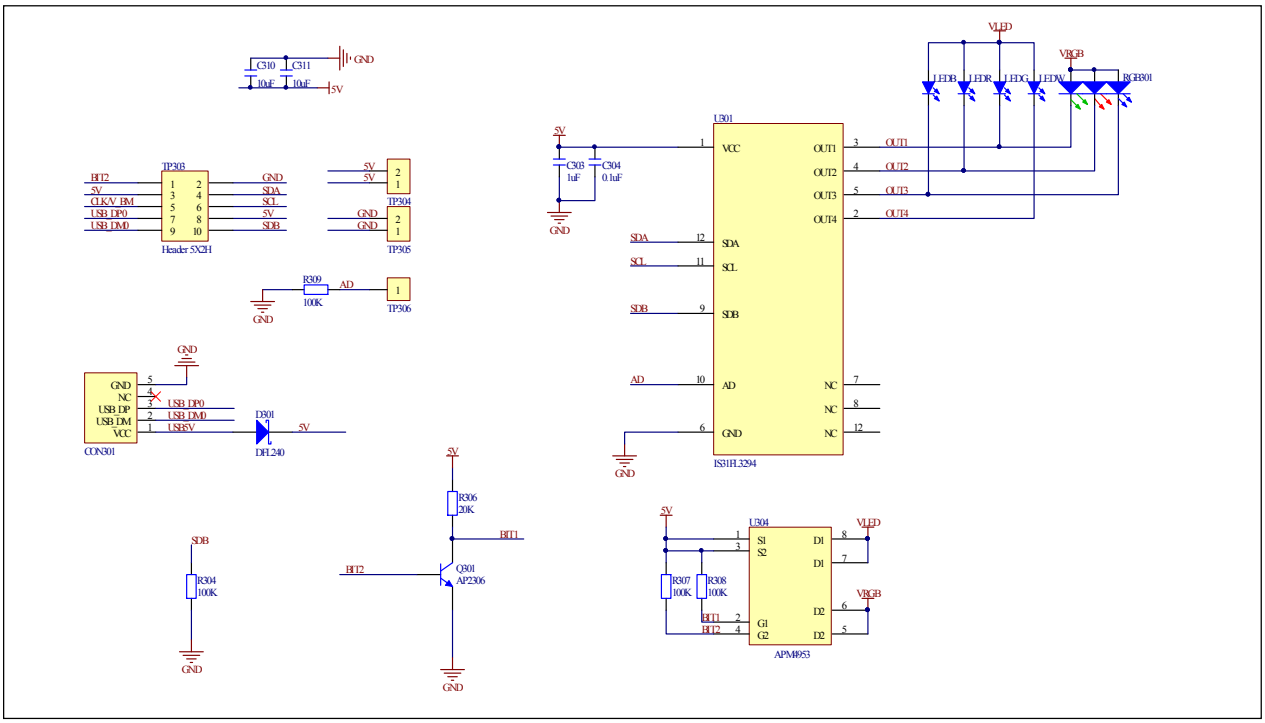

Figure 3: IS31FL3294 Application Schematic

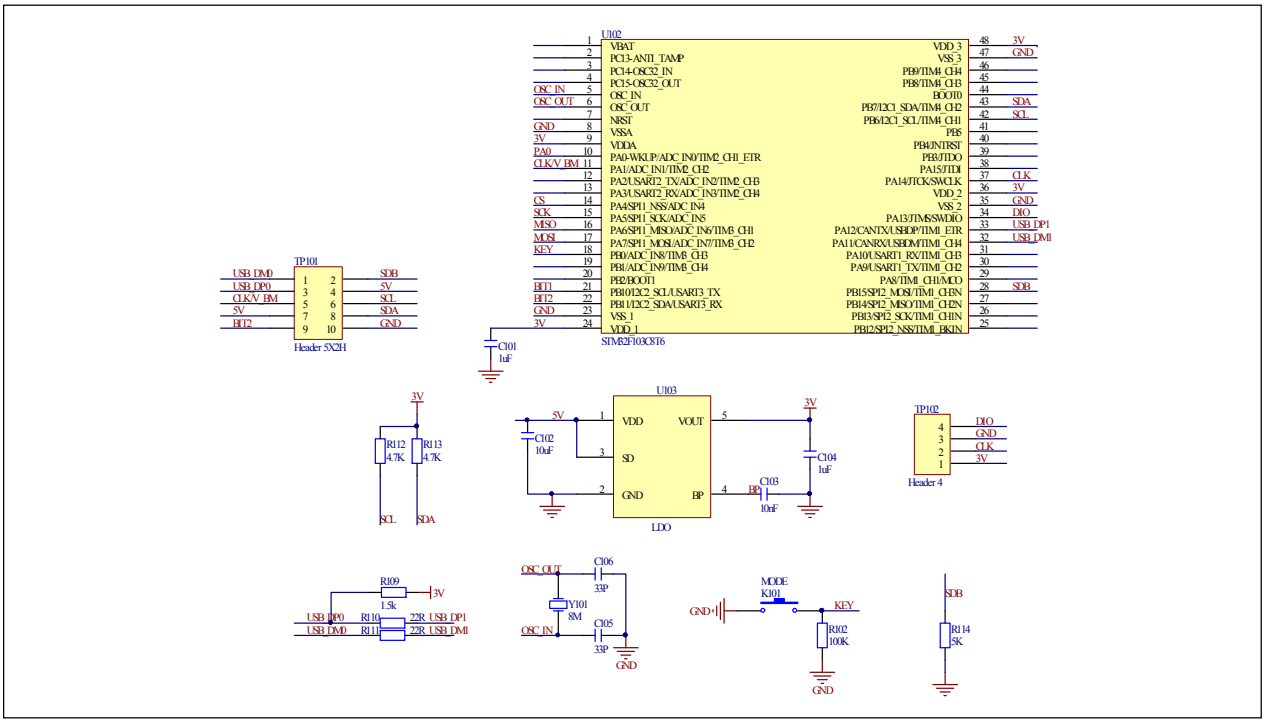

Figure 4: STM32F103C8T6 Application Schematic

BILL OF MATERIALS

IS31FL3294-UTLS4

Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U301	4-LED LED DRIVER	1	Lumissil	IS31FL3294
PMOS	U304	PMOS	1	ANPEC	APM4953
MOSFETs	Q301	N-Channel Power MOSFETs	1	APEC	AP2306
Diode	D301	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	LEDW	Diode, LED White, SMD	1	Everlight	GT-197
LED	RGB301	Diode, LED RGB, SMD	1	Everlight	99-235/RSGBB7C-A22/2D or 99-235/RGBC/TR8
Resistor	R304,R307, R308,R309	RES,100k,1/10W,±5%,SMD	4	Yageo	RC0603JR-07100KL
Resistor	R306	RES,20k,1/10W,±5%,SMD	2	Yageo	RC0603JR-0720KL
Capacitor	C303	CAP, 1μF,16V,±10%,SMD	1	Yageo	CC0603KRX7R7BB105
Capacitor	C304	CAP,100nF,16V,±20%,SMD	1	Yageo	CC0603MRX7R7BB104
Capacitor	C310,C311	CAP,10μF,16V,±20%,SMD	1	Yageo	CC0805MRX5R7BB106

Bill of Materials, refer to Figure 3 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 4 above.

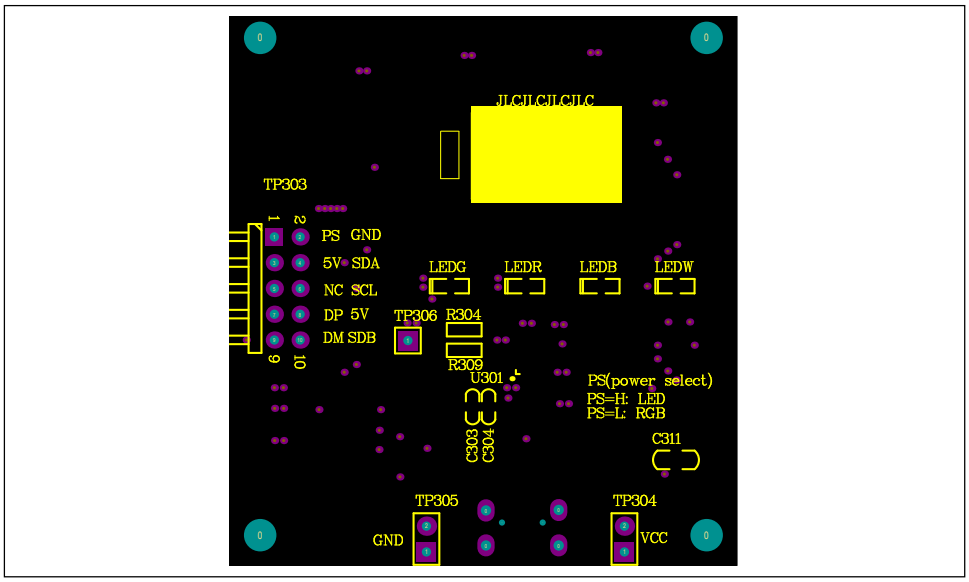

Figure 5: Board Component Placement Guide - Top Layer

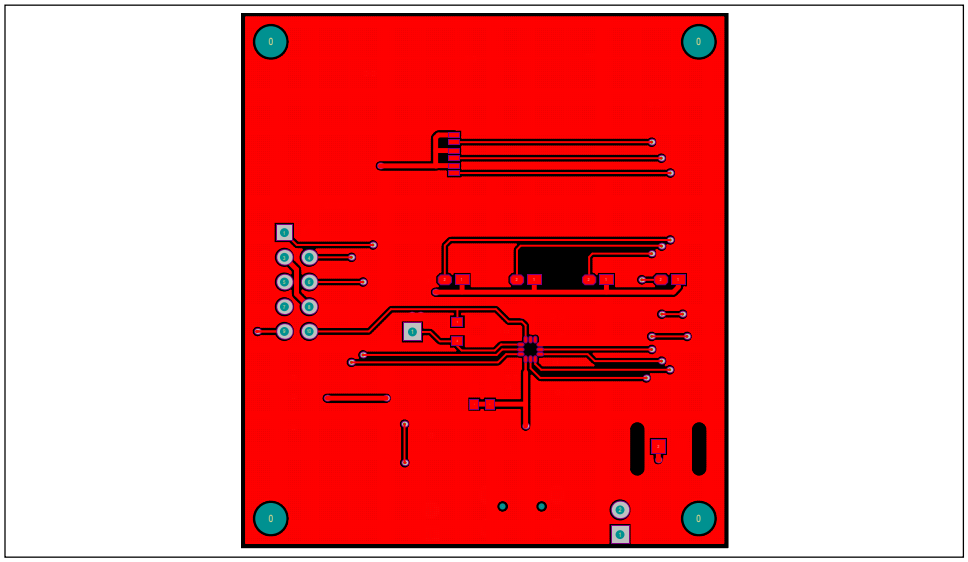

Figure 6: Board PCB Layout - Top Layer

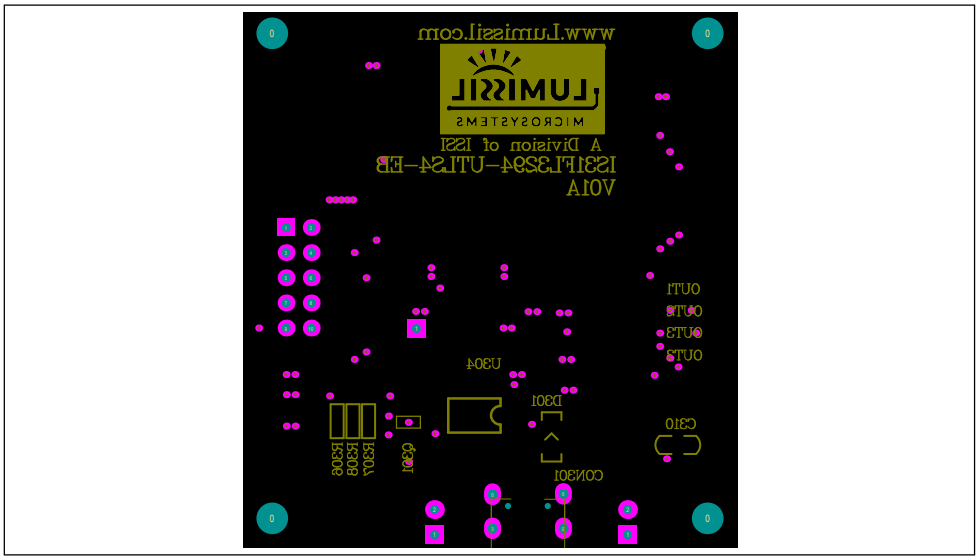

Figure 7: Board Component Placement Guide - Bottom Layer

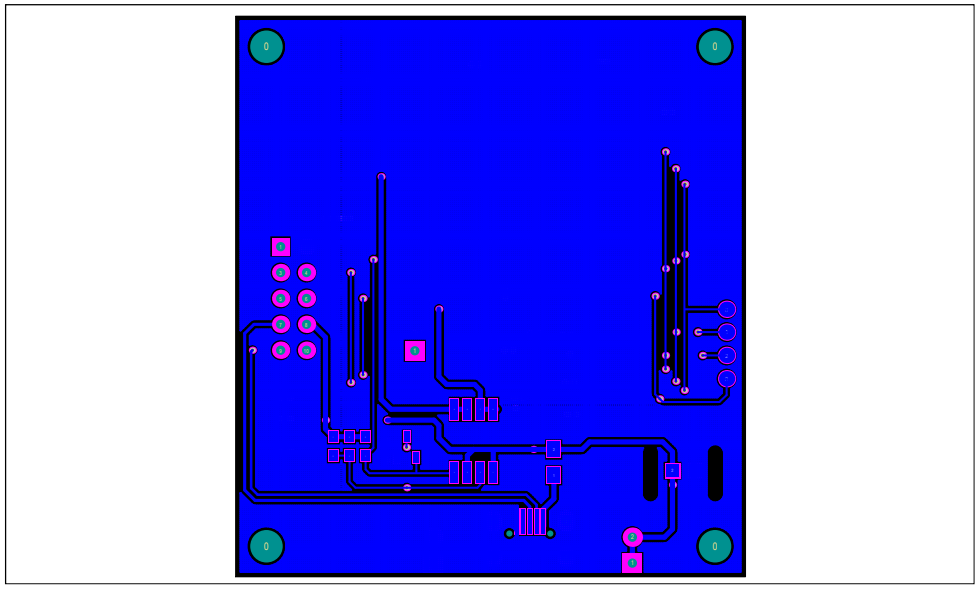

Figure 8: Board PCB Layout - Bottom Layer

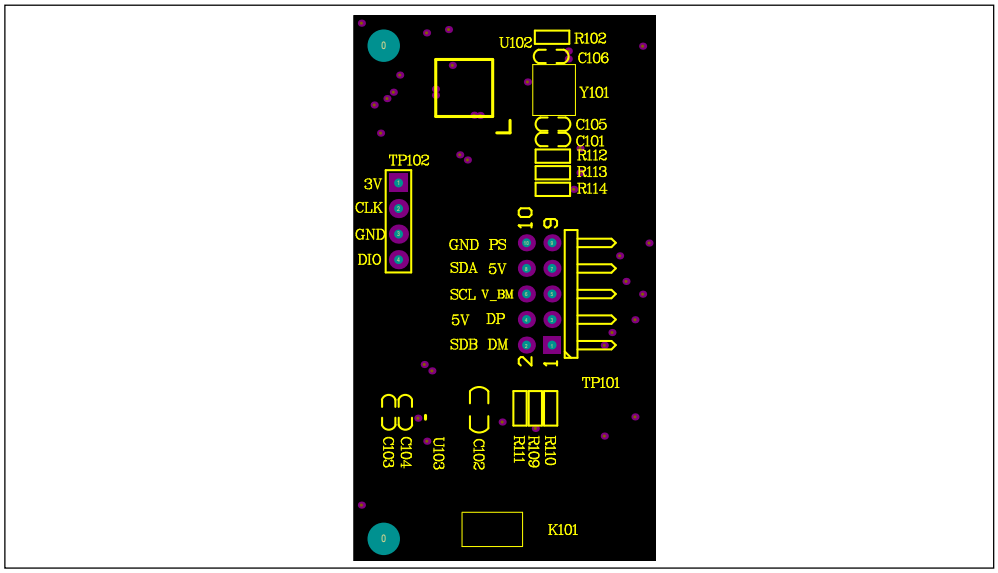

Figure 9: Board Component Placement Guide - Top Layer

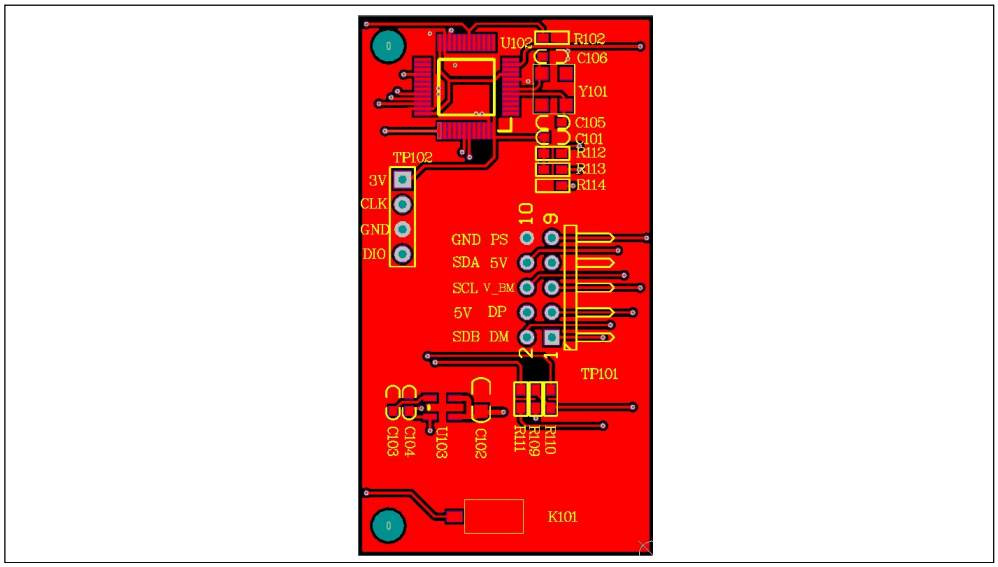

Figure 10: Board PCB Layout - Top Layer

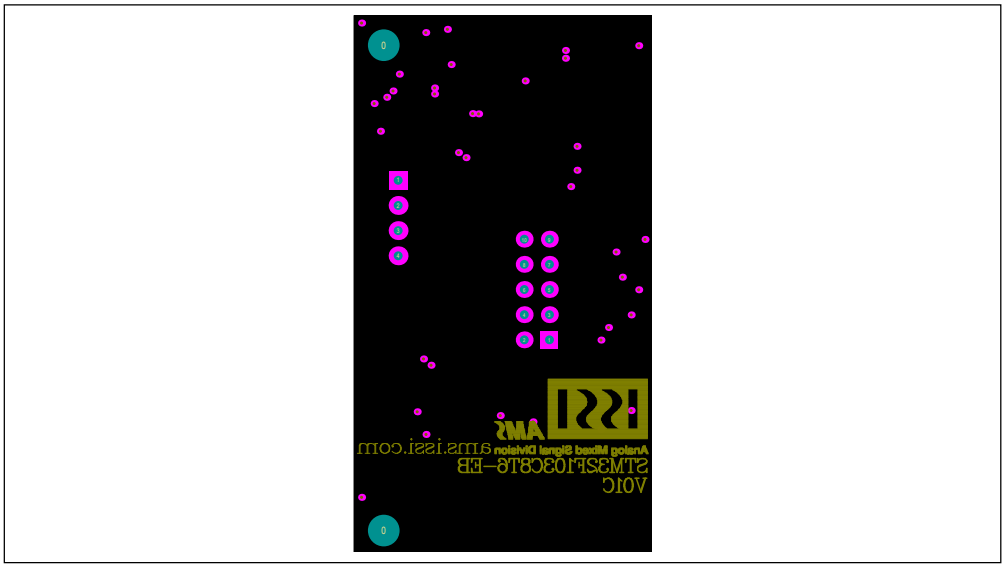

Figure 11: Board Component Placement Guide - Bottom Layer

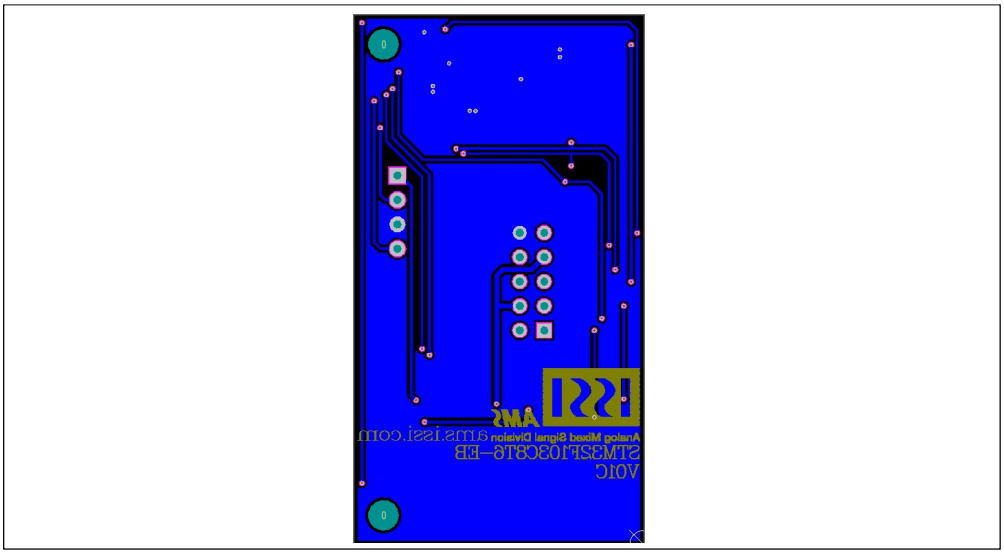

Figure 12: Board PCB Layout - Bottom Layer

REVISION HISTORY

Revision	Detail Information	Data
A	Initial release	2022.12.15

APPENDIX I: IS31FL3294 Arduino Test Code V01A

```
#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0xE8

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 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
   //delay(100); //keep 0.5s
   Init_FL3294();
   IS31FL3294_mode1();//RGB MODE mode
}

void loop() {
   // put your main code here, to run repeatedly:
   // delay(50);
}

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_FL3294(void)
{
   uint8_t i = 0;

   IS_IIC_WriteByte(Addr_GND,0x01,0x21);//Shutdown Control Register
   for(i=0x10;i<=0x13;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x40);//Color 1 Setting
   }
   for(i=0x20;i<=0x23;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x00);//Color 2 Setting
   }
   for(i=0x30;i<=0x33;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x00);//Color 3 Setting
   }

   for(i=0x40;i<=0x47;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x00);//PWM
   }

   IS_IIC_WriteByte(Addr_GND,0x52,0xC5);//Color Update
   IS_IIC_WriteByte(Addr_GND,0x53,0xC5);//PWM Update
   IS_IIC_WriteByte(Addr_GND,0x54,0xC5);//Pattern Update 1
   IS_IIC_WriteByte(Addr_GND,0x55,0xC5);//Pattern Update 2
   IS_IIC_WriteByte(Addr_GND,0x56,0xC5);//Pattern Update 3
}

void IS31FL3294_mode1(void)//white LED
```

```
{
   uint8_t i=0,j=0;
   IS_IIC_WriteByte(Addr_GND,0x04,0x40);//9 OUTPUT RGB MODE
   IS_IIC_WriteByte(Addr_GND,0x05,0x00);//

      for(i=0x10;i<=0x13;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x20);//Color 1 Setting
   }
      for(i=0x20;i<=0x23;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0x80);//Color 2 Setting
   }
      for(i=0x30;i<=0x33;i++)
   {
      IS_IIC_WriteByte(Addr_GND,i,0xFF);//Color 3 Setting
   }

   IS_IIC_WriteByte(Addr_GND,0x19,0x44);//Pattern TS &T1 Setting    0.51s
   IS_IIC_WriteByte(Addr_GND,0x1A,0x44);//Pattern T2 &T3 Setting    0.51s
   IS_IIC_WriteByte(Addr_GND,0x1B,0x44);//Pattern TP &T4 Setting    0.51s

   IS_IIC_WriteByte(Addr_GND,0x1C,0x07);//Pattern Color Enable
   IS_IIC_WriteByte(Addr_GND,0x1D,0x15);//Pattern Color Cycle
   IS_IIC_WriteByte(Addr_GND,0x1E,0x00);//Pattern
   IS_IIC_WriteByte(Addr_GND,0x1F,0x00);//Pattern Loop Times

   IS_IIC_WriteByte(Addr_GND,0x52,0xC5);//Color Update
   IS_IIC_WriteByte(Addr_GND,0x53,0xC5);//PWM Update
   IS_IIC_WriteByte(Addr_GND,0x54,0xC5);//Pattern TIME Update 1
   IS_IIC_WriteByte(Addr_GND,0x55,0xC5);//Pattern TIME Update 2
   IS_IIC_WriteByte(Addr_GND,0x56,0xC5);//Pattern TIME Update 3

}
```