

# 18-CHANNEL LED DRIVER EVALUATION BOARD GUIDE

## DESCRIPTION

IS31FL3238 is an LED driver with 18 constant current channels. Each channel can be pulse width modulated (PWM) by 16 bits for smooth LED brightness control. In addition, each channel has an 8-bit output current control register which allows fine tuning the current for rich RGB color mixing, e.g., a pure white color LED application. The maximum output current of each channel is designed to be 76mA, which can be adjusted by one 8-bit global control register. Proprietary programmable algorithms are used in IS31FL3238 to minimize audible noise caused by the MLCC decoupling capacitor. All registers can be programmed via a high speed I2C (1MHz).

## FEATURES

- 2.7V to 5.5V VCC supply
- Modulate LED brightness with 256/1024/4096/65536 steps PWM method
- Modulate LED DC current with 256 steps method
- Global 256 steps analog global current control
- PWM frequency selectable
- Open short detect function
- Spread spectrum
- QFN-28 (5mm×5mm) packages

## QUICK START

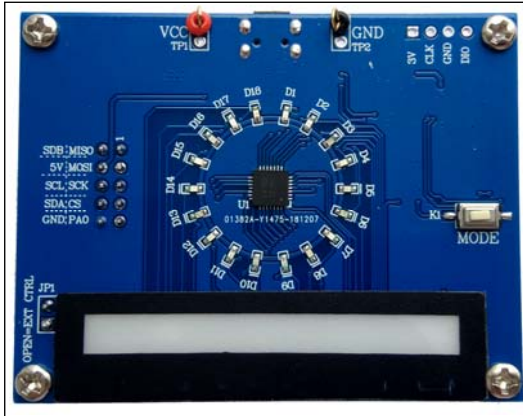


Figure 1: Photo of IS31FL3238-QWLS4 Evaluation Board

## 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 IS31FL3238 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) If using external DC power supply connect the ground terminal of the power supply to the evaluation board's GND pin and the positive terminal to the VCC pin. The evaluation board can also be powered via the Micro USB connector.
- 2) Short JP1 to disable external control.
- 3) Turn on the power supply/Plug in the Micro USB and pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.
- 4) Enter the desired mode of display by toggling the MODE button (K1).

## ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31FL3238-QFLS4-EB	-40°C to +125°C (Industrial)	QFN-28, Lead-free

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contact ISSI's analog marketing team at [analog@issi.com](mailto:analog@issi.com) or (408) 969-6600.

## EVALUATION BOARD OPERATION

The IS31FL3238 evaluation board has six display modes. Press MODE button to switch configurations.

- 1) (Default mode) Two groups single color LEDs chasing each other-A.
- 2) Two groups single color LEDs chasing each other-B.
- 3) Three groups single color LEDs chasing after each other.
- 4) Chasing cycle.
- 5) RGB LEDs (RGB1-RGB6) are breathing effect A-mixed color.
- 6) RGB LEDs (RGB1-RGB6) are breathing effect B.

**Note:** IS31FL3238 solely controls the FxLED function on the evaluation board.

## SOFTWARE SUPPORT

JP1 default setting is close circuit. If it is set to open, the on-board MCU will stop working. The I2C pins and SDB pin are set to High Impedance. External I2C and SDB signals can be connected to TP4 to control the IS31FL3238 LED driver. During external control mode, toggling the MODE button (K1) can switch the power of single blue color LED and power of RGB LED.

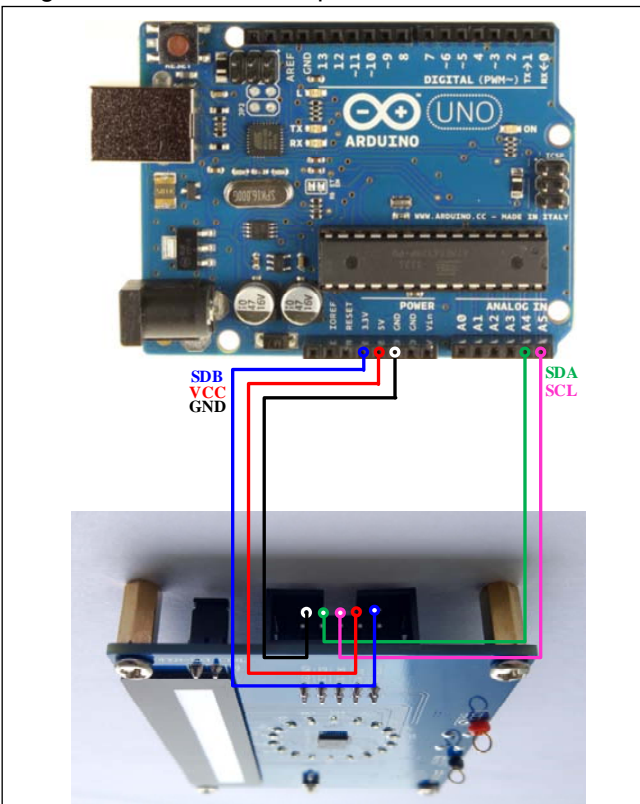


Figure 2: Photo of Arduino UNO connected to Evaluation Board

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](http://www.arduino.cc/en/Main/Software). Also download the Wire.h library from [www.arduino.cc/en/reference/wire](http://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 IS31FL3238 test firmware (sketch) from the ISSI website <http://ams.issi.com/US/product-analog-fxled-driver.shtml>.

- 1) Open JP1.
- 2) Connect the 5 pins from Arduino board to IS31FL3238 EVB:
  - a) Arduino 5V pin to IS31FL3238 EVB VCC.
  - b) Arduino GND to IS31FL3238 EVB GND.
  - c) Arduino SDA (A4) to IS31FL3238 EVB SDA.
  - d) Arduino SCL (A5) to IS31FL3238 EVB SCL.
  - e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3238 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 ISSI 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 Blue LED brightness every second.
- 5) During external control mode, toggling the MODE button (K1) can switch the power of single color LEDs and power of RGB LEDs.

**Please refer to the datasheet to get more information about IS31FL3238.**

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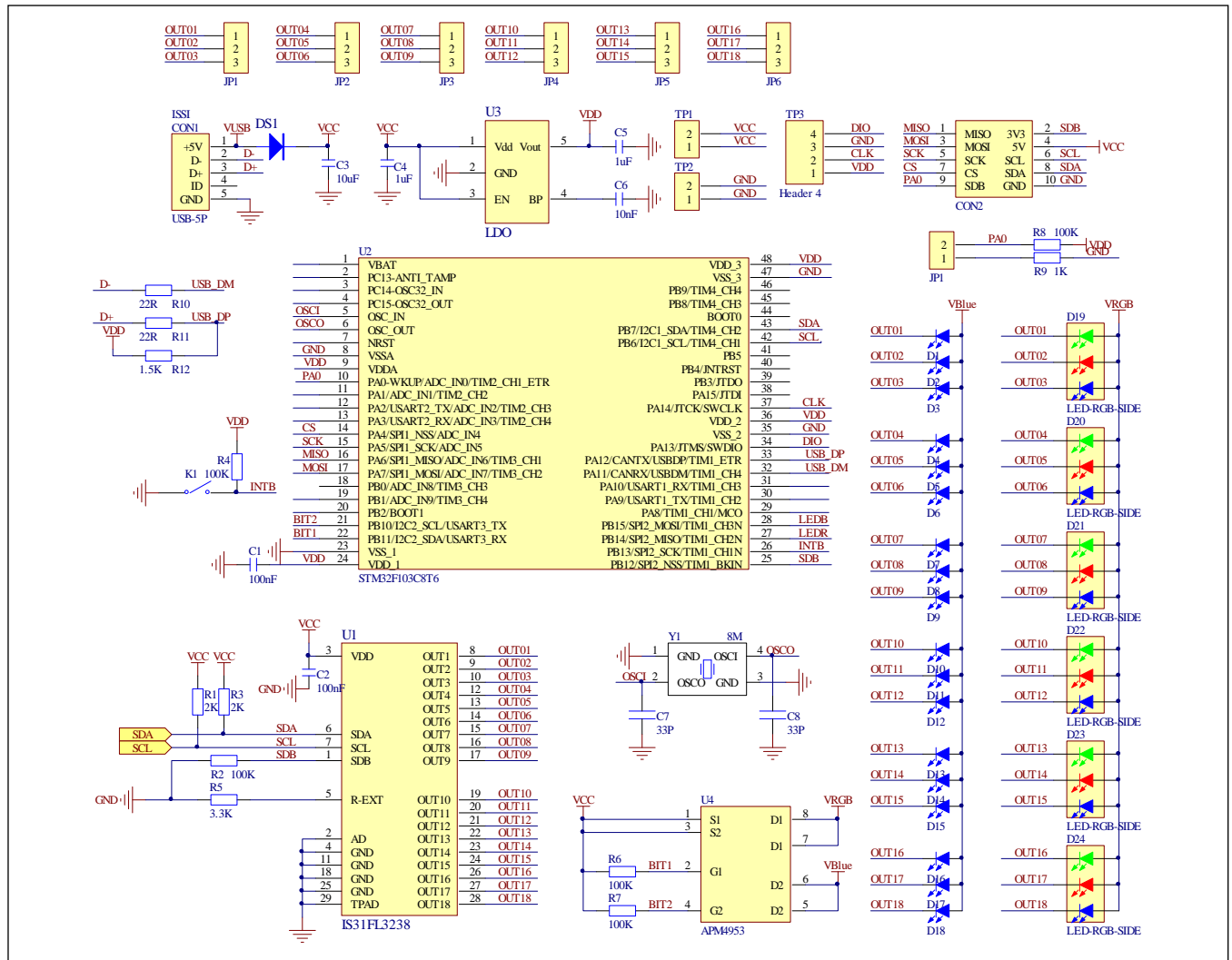


Figure 3: IS31FL3238 Application Schematic

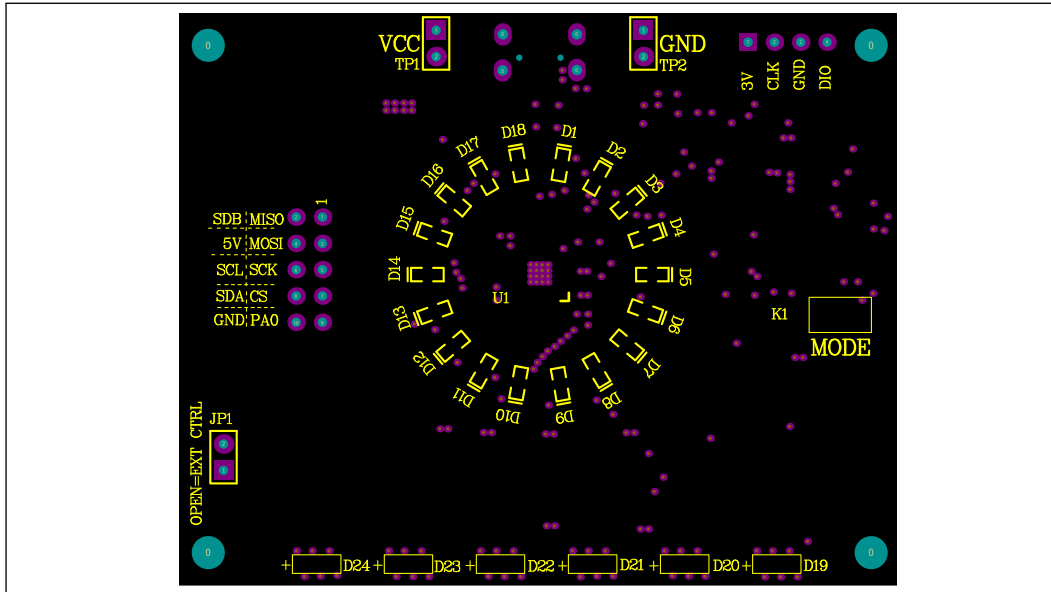
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## BILL OF MATERIALS

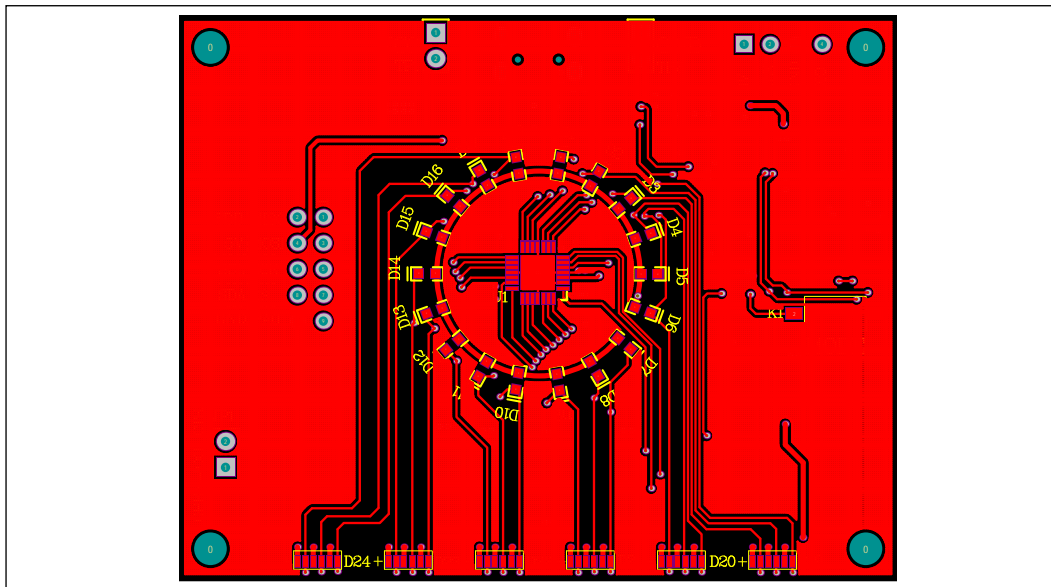
Name	Symbol	Description	Qty	Supplier	Part No.
LED Driver	U1	18CH FxLED Driver	1	ISSI	IS31FL3238
MCU	U2	Microcontroller	1	STM	STM32F103C8T6
LDO	U3	3.0V LDO	1	SGMICRO	SGM2019-3.0YN5G
PMOS	U4	Dual PMOS	1	ANPEC	APM4953
Crystal	Y1	Crystal, 8MHz	1	HLX	HC-49S
Diode	D1~D18	Diode, LED Blue, SMD	18	Everlight	19-217/BHC-AN1P2/3T
Diode	D19~D24	Diode, LED RGB, SMD	6	ROHM	SMLV56RGB1W1
Diode	DS1	Diode, SMD	1	DIODES	DFLS240
Resistor	R1,R3	RES,2k,1/10W,±5%,SMD	1	Yageo	RC0603JR-072KL
Resistor	R2,R4,R6, R7,R8	RES,100k,1/10W,±5%,SMD	5	Yageo	RC0603JR-07100KL
Resistor	R5	RES,3.3k,1/10W,±5%,SMD	1	Yageo	RC0603JR-073K3L
Resistor	R9	RES,1k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071KL
Resistor	R10, R11	RES,22R,1/10W,±5%,SMD	1	Yageo	RC0603JR-0722RL
Resistor	R12	RES,1.5k,1/10W,±5%,SMD	1	Yageo	RC0603JR-071K5L
Capacitor	C1,C2	CAP,100nF,16V,±20%,SMD	2	Yageo	CC0603MRX7R7BB104
Capacitor	C3	CAP,10µF,16V,±20%,SMD	1	Yageo	CC0603MRX5R7BB106
Capacitor	C4,C5	CAP,1µF,16V,±10%,SMD	2	Yageo	CC0603KRX7R7BB105
Capacitor	C6	CAP,10nF,16V,±10%,SMD	1	Yageo	CC0603KPX7R7BB103
Capacitor	C7, C8	CAP,33pF,50V,±5%,SMD	2	Yageo	CQ0603JRNPO9BN360
Button	K1	Button SMD	1		

Bill of Materials, refer to Figure 3 above.

**18-CHANNEL LED DRIVER EVALUATION BOARD GUIDE**



**Figure 4: Board Component Placement Guide - Top Layer**



**Figure 5: Board PCB Layout - Top Layer**

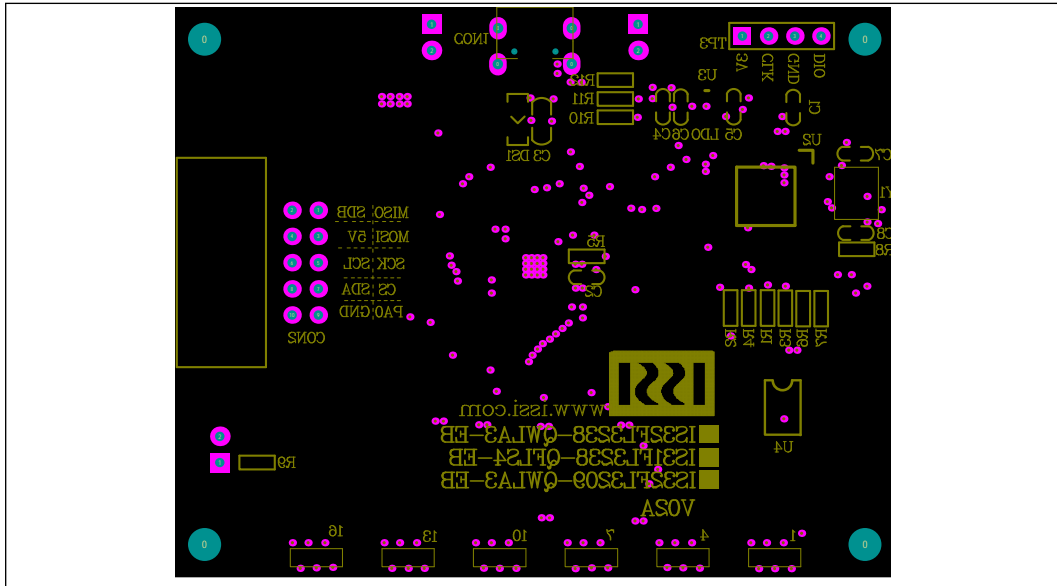


Figure 6: Board Component Placement Guide - Bottom Layer

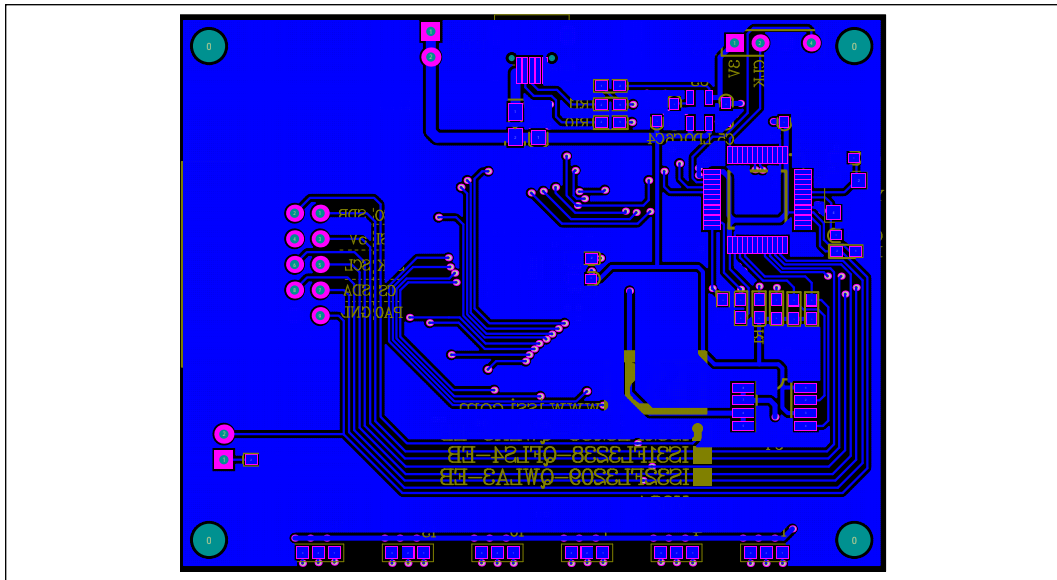


Figure 7: Board PCB Layout - Bottom Layer

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- b.) the user assume all such risks; and
- c.) potential liability of Integrated Silicon Solution, Inc is adequately protected under the circumstances

## REVISION HISTORY

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Revision	Detail Information	Data
A	Initial Release	2018.09.17
B	Update schematic and PCB layout	2018.12.28

## APPENDIX I : IS31FL3238 Arduino Test Code V01A

```

#include<Wire.h>
#include<avr/pgmspace.h>
#define Addr_GND 0x68
//7 bit format is 0x3F

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_FL3238();
}

void loop() {
  // put your main code here, to run repeatedly:
  // delay(50);
  Init_FL3238();
  IS31FL3238_mode1();//breath mode
}

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_FL3238(void)
{
  uint8_t i = 0;
  for(i=0x4A;i<=0x6D;i++)
  {
    IS_IIC_WriteByte(Addr_GND,i,0xFF);//write all scaling
  }
  IS_IIC_WriteByte(Addr_GND,0x6e,0xff);//GCC
  IS_IIC_WriteByte(Addr_GND,0x49,0x00);//update PWM & congtrol registers
  IS_IIC_WriteByte(Addr_GND,0x00,0x01);//normal operation
}

void IS31FL3238_mode1(void)//white LED
{
  int i=0,j=0;
  for(j=0;j<=63;j++)
  {
    for(i=0x01;i<=0x47;i=i+2)
    {
      IS_IIC_WriteByte(Addr_GND,i, PWM_Gamma64[j]);//write all PWM set 0x80
      IS_IIC_WriteByte(Addr_GND,0x49,0x00);//update PWM & congtrol registers
    }
    delay(10); //keep 0.5s
  }
  for(j=63;j>=0;j--)
  {
    for(i=0x01;i<=0x47;i=i+2)
    {

```



## 18-CHANNEL LED DRIVER EVALUATION BOARD GUIDE

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```
IS_IIC_WriteByte(Addr_GND,i, PWM_Gamma64[j]); //write all PWM set 0x80
IS_IIC_WriteByte(Addr_GND,0x49,0x00); //update PWM & congtrol registers
}
delay(10); //keep 0.5s
}
}
```