DESCRIPTION
The IS31FL3741 is a general purpose 39×9 LED Matrix programmed via an I2C compatible interface. Each LED can be dimmed individually with 8-bit PWM data and 8-bit scaling data which allowing 256 steps of linear PWM dimming and 256 steps of DC current adjustable level.

Additionally each LED open and short state can be detected, IS31FL3741 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 from 2.7V to 5.5V
- 39 Current Sink × 9 SW matrix size: drive up to 351 LEDs or 117 RGBs
- Individual 256 PWM control steps
- Individual 256 DC current steps
- Global 255 current setting
- SDB rising edge reset I2C module
- Interrupt and state lookup registers
- Individual open and short error detect function
- De-ghost
- QFN-60 (7mm×7mm) package

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 IS31FL3741 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 3V and P2.
2) Connect SDA and P1.
3) Connect SCL and P3.
4) Connect SDB and P4
5) Connect PVCC and SDB.
6) Turn on the power supply/Plug in the Micro USB

Pay attention to the supply current. If the current exceeds 1A, please check for circuit fault.

EVALUATION BOARD OPERATION
The IS31FL3741 evaluation board has three animation display modes. Press K1 to switch configurations.

1) Rainbow wave#1
2) Rainbow wave#2
3) Rain
4) Visor

Note: IS31FL3741 solely controls the FxLED function on the evaluation board.

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Temperature Range</th>
<th>Package</th>
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</thead>
<tbody>
<tr>
<td>IS31FL3741-QFLS4-EB</td>
<td>-40°C to +125°C (Industrial)</td>
<td>QFN-60, Lead-free</td>
</tr>
</tbody>
</table>

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contacts ISSI's analog marketing team at analog@issi.com or (408) 969-6600.
SOFTWARE SUPPORT

P2 and 3V default setting is closed (jumper on). If it is open (no jumper), the on-board MCU will configure its own I2C/SDB/ADDR pins to High Impedance status so an external source can drive the I2C/SDB signals to control the IS31FL3741 LED driver.

The ADDR pin is pulled high via R6 setting the device address of IS31FL3741 to 0x60.

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 IS31FL3741 test firmware (sketch) from the ISSI website http://www.issi.com/US/product-analog-fxled-drivers.html.

1) Open P2 and 3V.
2) Open PVCC and SDB.
3) Connect the 5 pins from Arduino board to IS31FL3741 EVB:
   a) Arduino 5V pin to IS31FL3741 EVB PVCC.
   b) Arduino GND to IS31FL3741 EVB GND.
   c) Arduino SDA (A4) to IS31FL3741 EVB P1.
   d) Arduino SCL (A5) to IS31FL3741 EVB P3.
   e) If Arduino use 3.3V MCU VCC, connect 3.3V to IS31FL3741 EVB SDB, if Arduino use 5.0V MCU VCC, connect 5.0V to EVB SDB. (Arduino UNO is 5.0V, so SDB=5.0V)
4) 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.
5) Run the Arduino code as appendix I.
6) In EVB code, the ADDR pin is pulled low via 100k, so the device address is 0x60. When P1~P4 are disconnect, the ADDR pin can be changed by connecting the ADDR as follows:
   a) ADDR=VCC, device address=0x66.
   b) ADDR=SCL, device address=0x62.
   c) ADDR=SDA, device address=0x64.

Please refer to the datasheet to get more information about IS31FL3741.
Figure 3: IS31FL3741 Application Schematic
### BILL OF MATERIALS

<table>
<thead>
<tr>
<th>Name</th>
<th>Symbol</th>
<th>Description</th>
<th>Qty</th>
<th>Supplier</th>
<th>Part No.</th>
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</thead>
<tbody>
<tr>
<td>LED Driver</td>
<td>U1</td>
<td>Matrix LED Driver</td>
<td>1</td>
<td>ISSI</td>
<td>IS31FL3741</td>
</tr>
<tr>
<td>LDO</td>
<td>U2</td>
<td>Reduced voltage</td>
<td>1</td>
<td>SGMICRO</td>
<td>SGM2019-3.3V</td>
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<tr>
<td>MCU</td>
<td>U3</td>
<td>Microcontroller</td>
<td>1</td>
<td>STM</td>
<td>STM32F103C8T6</td>
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<td>Diode</td>
<td>LD1~LD117</td>
<td>Blue LED, SMD</td>
<td>117</td>
<td>Everlight</td>
<td>9-237/R6GHBHC-A01/2T</td>
</tr>
<tr>
<td>Diode</td>
<td>D1,D2</td>
<td>Diode, SMD</td>
<td>2</td>
<td>DIODES</td>
<td>DFLS240</td>
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<tr>
<td>Crystal</td>
<td>Y1</td>
<td>Crystal, 8MHz</td>
<td>1</td>
<td>JB</td>
<td>HC-49S</td>
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<tr>
<td>Resistor</td>
<td>R1,R2</td>
<td>RES, 4.7k, 1/16W, ±5%, SMD</td>
<td>2</td>
<td>Yageo</td>
<td>RC0603JR-074K7L</td>
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<tr>
<td>Resistor</td>
<td>R3,R4,R6</td>
<td>RES, 100k, 1/16W, ±5%, SMD</td>
<td>3</td>
<td>Yageo</td>
<td>RC0603JR-07100KL</td>
</tr>
<tr>
<td>Resistor</td>
<td>R5,R50,R46</td>
<td>RES, 10k, 1/16W, ±5%, SMD</td>
<td>3</td>
<td>Yageo</td>
<td>RC0603JR-0710KL</td>
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<tr>
<td>Resistor</td>
<td>R47</td>
<td>RES, 1.5k, 1/16W, ±5%, SMD</td>
<td>1</td>
<td>Yageo</td>
<td>RC0603JR-071K5L</td>
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<tr>
<td>Resistor</td>
<td>R48,R49</td>
<td>RES, 22R, 1/16W, ±5%, SMD</td>
<td>2</td>
<td>Yageo</td>
<td>RC0603JR-0722RL</td>
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<td>Resistor</td>
<td>CS01~CS39</td>
<td>RES, 10R, 1/16W, ±5%, SMD</td>
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<td>Yageo</td>
<td>RC0603JR-0710RL</td>
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<td>Capacitor</td>
<td>C1,C2,C3</td>
<td>CAP, 0.1μF, 16V, ±20%, SMD</td>
<td>3</td>
<td>Yageo</td>
<td>CC0603KKX7R9BB104</td>
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<tr>
<td>Capacitor</td>
<td>C4,C6,C9</td>
<td>CAP, 1μF, 16V, ±20%, SMD</td>
<td>3</td>
<td>Yageo</td>
<td>CC0603KKX7R9BB105</td>
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<tr>
<td>Capacitor</td>
<td>C5,C8</td>
<td>CAP, 33pF, 16V, ±20%, SMD</td>
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<td>Yageo</td>
<td>CC0603KKX7R9BB330</td>
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<td>Capacitor</td>
<td>C7</td>
<td>CAP, 10nF, 16V, ±20%, SMD</td>
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<td>CC0603KKX7R9BB103</td>
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<tr>
<td>Capacitor</td>
<td>C10,C11</td>
<td>CAP, 10μF, 16V, ±20%, SMD</td>
<td>2</td>
<td>Yageo</td>
<td>CC0805KKX7R9BB106</td>
</tr>
<tr>
<td>Button</td>
<td>K1</td>
<td>Button, SMD</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Bill of Materials, refer to Figure 3 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: LED Board Component Placement Guide - Top Layer

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

Figure 11: LED Board PCB Layout - Bottom Layer

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Rev. A, 09/07/2017
## REVISION HISTORY

<table>
<thead>
<tr>
<th>Revision</th>
<th>Detail Information</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Initial release</td>
<td>2017.09.07</td>
</tr>
</tbody>
</table>
#include <Wire.h>
#include <avr/pgmspace.h>

#define Addr_GND 0x60
#define R 0xFF
#define G 0x00
#define B 0xFF

const PROGMEM byte PWM_Gama64[64] =
{
  0x00,0x01,0x02,0x03,0x04,0x05,0x06,0x07,
  0x08,0x09,0x0a,0x0b,0x0c,0x0d,0x0e,0x0f,
  0x10,0x11,0x12,0x13,0x14,0x15,0x16,0x17,
  0x18,0x19,0x1a,0x1b,0x1c,0x1d,0x1e,0x1f,
  0x20,0x21,0x22,0x23,0x24,0x25,0x26,0x27,
  0x28,0x29,0x2a,0x2b,0x2c,0x2d,0x2e,0x2f,
  0x30,0x31,0x32,0x33,0x34,0x35,0x36,0x37,
  0x38,0x39,0x3a,0x3b,0x3c,0x3d,0x3e,0x3f,
  0x40,0x41,0x42,0x43,0x44,0x45,0x46,0x47,
  0x48,0x49,0x4a,0x4b,0x4c,0x4d,0x4e,0x4f,
  0x50,0x51,0x52,0x53,0x54,0x55,0x56,0x57,
  0x58,0x59,0x5a,0x5b,0x5c,0x5d,0x5e,0x5f,
  0x60,0x61,0x62,0x63,0x64,0x65,0x66,0x67,
  0x68,0x69,0x6a,0x6b,0x6c,0x6d,0x6e,0x6f,
  0x70,0x71,0x72,0x73,0x74,0x75,0x76,0x77,
  0x78,0x79,0x7a,0x7b,0x7c,0x7d,0x7e,0x7f,
};

void setup()
{
  Wire.begin();
  Wire.setClock(1000000); // I2C 1MHz
  Init_3741(R, G, B);
}

void loop()
{
  IS31FL3741_Test_mode1(); // breath mode
}

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 Init_3741(uint8_t Rdata, uint8_t Gdata, uint8_t Bdata)
{
  IS_IIC_WriteByte(Addr_GND, 0xfe, 0xc5); // unlock
  IS_IIC_WriteByte(Addr_GND, 0xfD, 0x02); // write page 2
  for(i=2;i<0xB4; i++)
  }
{ 
    IS_IIC_WriteByte(Addr_GND,i,Rdata);//R LED Scaling 
}
for(i=1;i<0xB4;i+=3)
{
    IS_IIC_WriteByte(Addr_GND,i,Gdata);//G LED Scaling 
}
for(i=0;i<0xB4;i+=3)
{
    IS_IIC_WriteByte(Addr_GND,i,Bdata);//B LED Scaling 
}
IS_IIC_WriteByte(Addr_GND,0xfe,0xc5);//unlock 
IS_IIC_WriteByte(Addr_GND,0xfD,0x03);//write page 3 
for(i=2;i<0xAB;i+=3)
{
    IS_IIC_WriteByte(Addr_GND,i,Rdata);//R LED Scaling 
}
for(i=1;i<0xAB;i+=3)
{
    IS_IIC_WriteByte(Addr_GND,i,Gdata);//G LED Scaling 
}
for(i=0;i<0xAB;i+=3)
{
    IS_IIC_WriteByte(Addr_GND,i,Bdata);//B LED Scaling 
}
IS_IIC_WriteByte(Addr_GND,0xfe,0xc5);//unlock 
IS_IIC_WriteByte(Addr_GND,0xfD,0x00);//write page 0 
for(i=0;i<0xB4;i++)
{
    IS_IIC_WriteByte(Addr_GND,i,0x00);//write all PWM set 0x00 
}
IS_IIC_WriteByte(Addr_GND,0xfe,0xc5);//unlock 
IS_IIC_WriteByte(Addr_GND,0xfD,0x01);//write page 1 
for(i=0;i<0xAB;i++)
{
    IS_IIC_WriteByte(Addr_GND,i,0x00);//write all PWM set 0x00 
} //init all the PWM data to 0 

void IS31FL3741_Test_mode1(void)/

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Rev. A, 09/07/2017
{ IS_IIC_WriteByte(Addr_GND,0xFD,0x00); //write frist frame for (j=0;j<64;j++) //all LED ramping up {
    IS_IIC_WriteByte(Addr_GND,0xfe,0xc5); //unlock
    IS_IIC_WriteByte(Addr_GND,0xFD,0x00); //write page 0
    for(i=0;i<0xB4;i++) {
        IS_IIC_WriteByte(Addr_GND,i,pgm_read_byte_near(&PWM_Gama64[j])); //set all PWM
    }
    IS_IIC_WriteByte(Addr_GND,0xfe,0xc5); //unlock
    IS_IIC_WriteByte(Addr_GND,0xfD,0x01); //write page 1
    for(i=0;i<0xAB;i++) {
        IS_IIC_WriteByte(Addr_GND,i,pgm_read_byte_near(&PWM_Gama64[j])); //set all PWM
    }
    delay(10); //10ms
}
delay(1000); //keep on 1s

for (j=63;j>0;j--) //all LED ramping down {
    IS_IIC_WriteByte(Addr_GND,0xfe,0xc5); //unlock
    IS_IIC_WriteByte(Addr_GND,0xFD,0x00); //write page 0
    for(i=0;i<0xB4;i++) {
        IS_IIC_WriteByte(Addr_GND,i,pgm_read_byte_near(&PWM_Gama64[j-1])); //set all PWM
    }
    IS_IIC_WriteByte(Addr_GND,0xfe,0xc5); //unlock
    IS_IIC_WriteByte(Addr_GND,0xFD,0x01); //write page 1
    for(i=0;i<0xAB;i++) {
        IS_IIC_WriteByte(Addr_GND,i,pgm_read_byte_near(&PWM_Gama64[j-1])); //set all PWM
    }
    delay(10); //10ms
}
delay(500); //keep off 0.5s
}