high gray scale display 3-channel LED constant current driver

UCS8903

GENERAL DESCRIPTION

The UCS8903 is a 3-channel LED display driver / controller with a built-in MCU digital interface, data latches and LED high voltage driving functions. It features superior performances and reliable functions. Under the control of the external MCU, it performs independent grayscale control through data-cascading transfer for driving large outdoor colour dot-matrix LED panels.
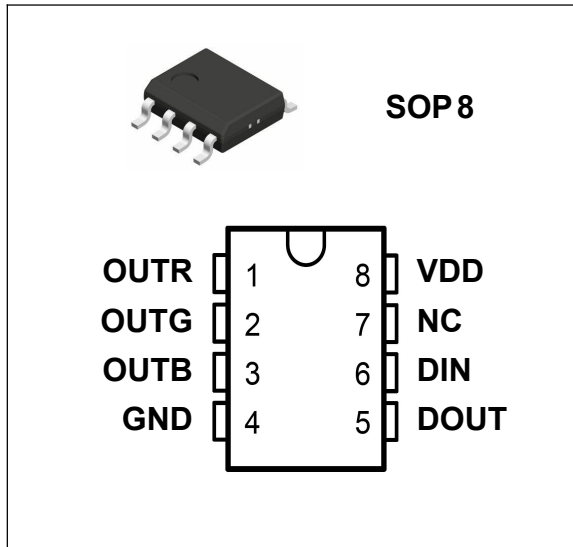
FEATURES

1. single line data tronsmission（return to zero code）
2. shaping transmit specific technology, Cascade number of lamps and lanterns is not restricted
3. cascading ability enhancement technology, Any 2 lanterns spacing can be up to 10 meters
4. Data transfer rate of 800 k/s, Images of not less than 512 points can be realized when the refresh rate of 30 frames per second,
5. RGB output port PWM control can be achieved **_65536_** grey level adjustment, port scanning frequency of 1 KHz/s
6. chip VDD built-in 5 v voltage regulator tube, output port Withstand Voltage is greater than 24 V
7. adopt the preset 17 mA/channel constant current mode. High precision of constant current , differences of current between Channel is less than ±1.5%,the differences of current between Chip is less than ±3%
8. when power up ,IC self-inspection then Light connection on the pin B lamp
9. SA-I Anti-interference patent technology for single line data tronsmission
10. Industrial design, stable and reliable

Application:

Point light source   full color module   full color light bar   LED decorate..

PIN CONFIGURATION

```
                              SOP 8

  OUTR  ┌ 1      8 ┐  VDD
  OUTG  ┌ 2      7 ┐  NC
  OUTB  ┌ 3      6 ┐  DIN
  GND   ┌ 4      5 ┐  DOUT
```

PIN DESCRIPTION

Number	Symbol	Name	Function Description
1	OUTR	LED drive output	Red PWM control output
2	OUTG	LED drive output	Green PWM control output
3	OUTB	LED drive output	Blue PWM control output
4	GND	Ground	Ground
5	DOUT	Data output	Display data cascaded output
6	DIN	Data input	Display data cascaded input
7	NC		
8	VDD		Logic power supply

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\,℃$, $V_{SS} = 0\,V$, unless otherwise specified)

Parameter	Symbol	Value	Unit
Logic supply voltage	V_{DD}	$+7.0$	V
Output port limitation voltage	V_{OUT}	28	V
Logic input voltage	V_I	-0.5 to $V_{DD}+0.5$	V
Operating temperature	T_{OPT}	-40 to $+85$	℃
Storage temperature	T_{STG}	-55 to $+150$	℃
antistatic	ESD	6000	V
output rating	Pd	400	mW

RECOMMENDED OPERATNG RANGES ($T_A = -20$ to $+70\,℃$, $V_{SS} = 0\,V$, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max	Unit
Logic supply voltage	V_{DD}	-	5.5	-	V
High level input voltage	V_{IH}	$0.7\,V_{DD}$	-	V_{DD}	V
Low level input voltage	V_{IL}	0	-	$0.3\,V_{DD}$	V
Output port rated voltage	Vout	24			V

ELECTRICAL CHARACTERISTICS ($T_A = -20$ to $+70\,℃$, $V_{DD} = 4.5$ to $5.5\,V$, $V_{SS} = 0\,V$, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
Low level output current	Iout	16.5	17	17.5	mA	R，G，B
Low level output current	Ido	10	-	-	mA	Vo = 0.4 V, Dout
High level input voltage	Vih	0.6Vdd	-		V	
Low level input voltage	Vil	-	-	0.3 Vdd	V	
Voltage hysteresis	Vh	-	0.35	-	V	
quiescent current	IDDdyn			1	mA	无负载
rated power	PD			250	mW	（Ta=25℃）
thermal resistance	Rth(j-a)		80	190	℃/W	

SWITCHING CHARACTERISTICS ($T_A = -20$ to $+70$ ℃, $V_{DD} = 4.5$ to 5.5 V, $V_{SS} = 0$ V, unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
Propagation delay time	t_{PLZ}	-	-	300	ns	$C_L = 15$ pF, DIN→DOUT, $R_L = 10$ kΩ
Fall time	t_{THZ}	-	-	120	µs	$C_L = 300$ pF, OUTR/OUTG/OUTB
Data transfer rate	F_{MAX}	800	-	-	kbps	50 % duty cycle
Input capacitance	C_I	-	-	15	pF	-

48-bit data format

R15	R14	R13	R12	R11	R10	R9	R8	R7	R6	R5	R4	R3	R2	R1	R0
G15	G14	G13	G12	G11	G10	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0
B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

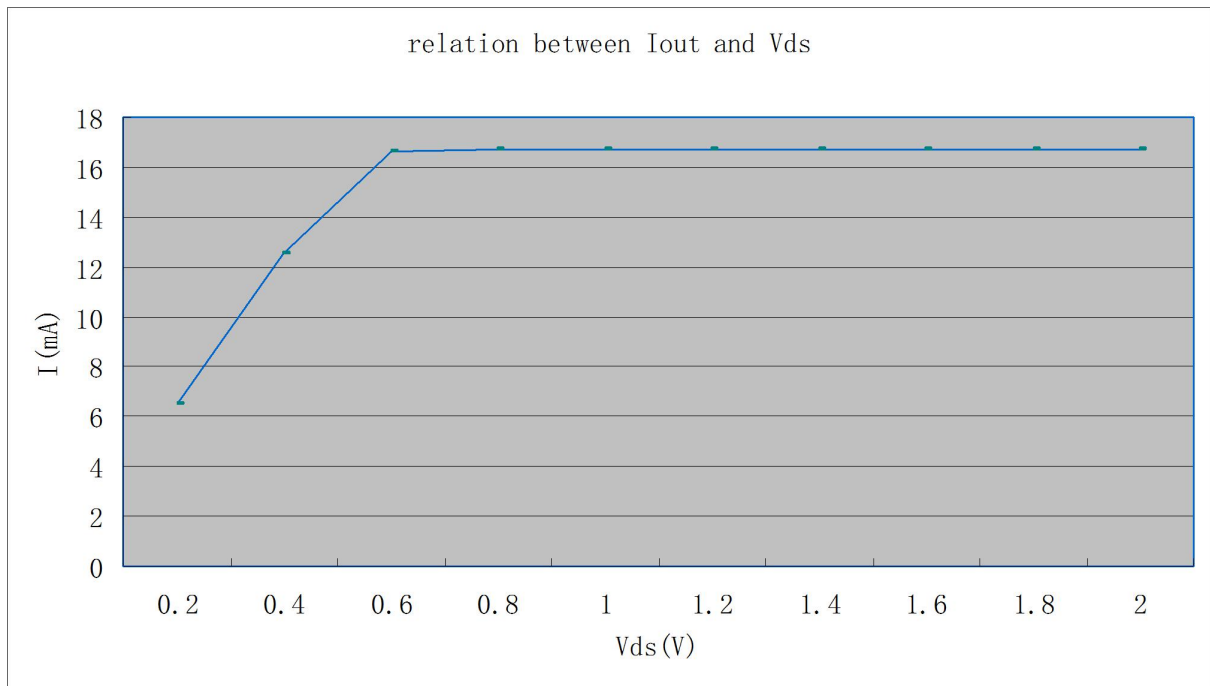**Note:** The data is sent in the sequence of RGB, and the MSB is sent first.

constant current characteristic

UCS8903 Constant current characteristic is excellent， between Channel ，even between chip ，the differences of current is tiny

(1): the differences of current between Channel is less than ±1.5%。the differences of current between Chip is less than ±3%
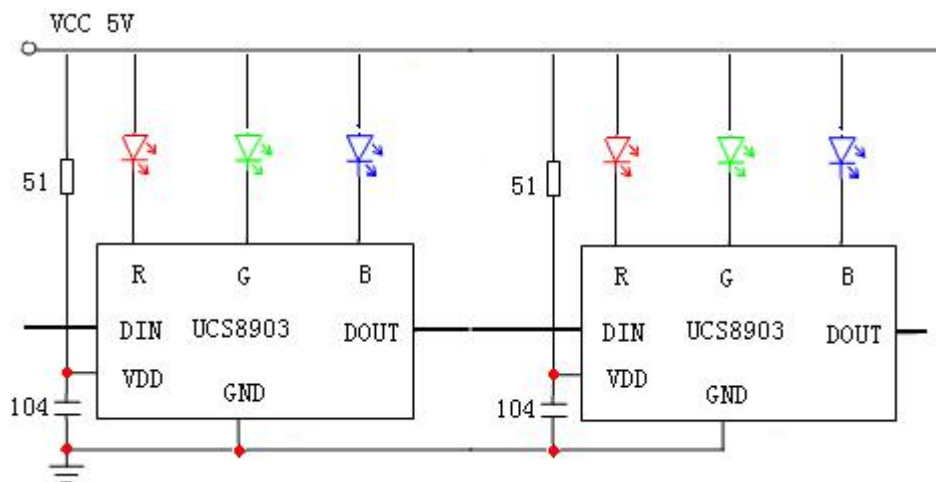
(2): When the voltage of the load change, UCS8903 output current is not affected, as shown in the figure below

(3): Below UCS8903 output port of the current Iout and add on the port voltage Vds curve relationship。the smaller the Iout current，the smaller in the condition of constant current need of Vds.
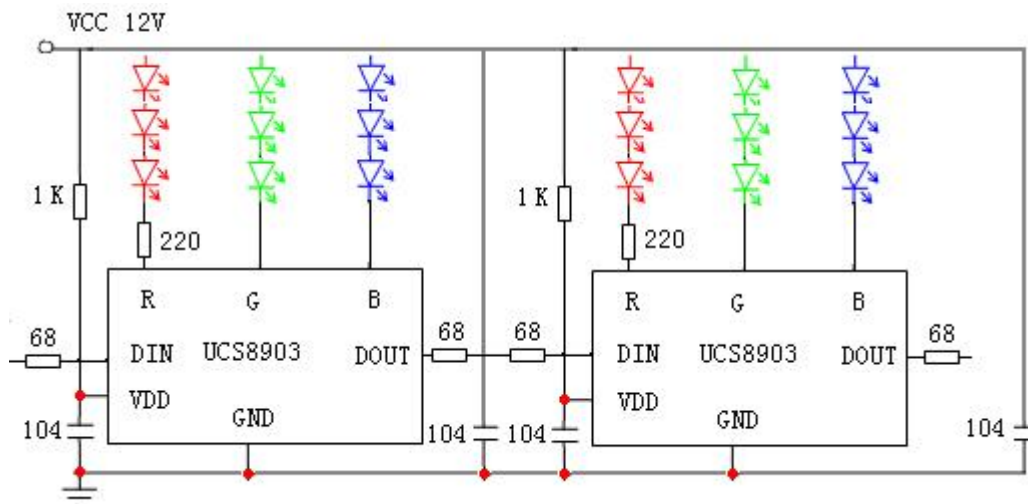
relation between Iout and Vds

I (mA) vs **Vds (V)**

The graph shows current rising from about 6.5 mA at 0.2V, to about 12.6 mA at 0.4V, reaching approximately 16.7 mA at 0.6V and remaining constant through 2.0V.

Typical Application circuit diagram

1．Power voltage is 5V

VCC 5V

51

104

R   G   B
DIN UCS8903 DOUT
VDD   GND

51

104

R   G   B
DIN UCS8903 DOUT
VDD   GND

Using constant current mode can be voltage falling at the same time to achieve ideal effect of brightness and color temperature is kept constant.
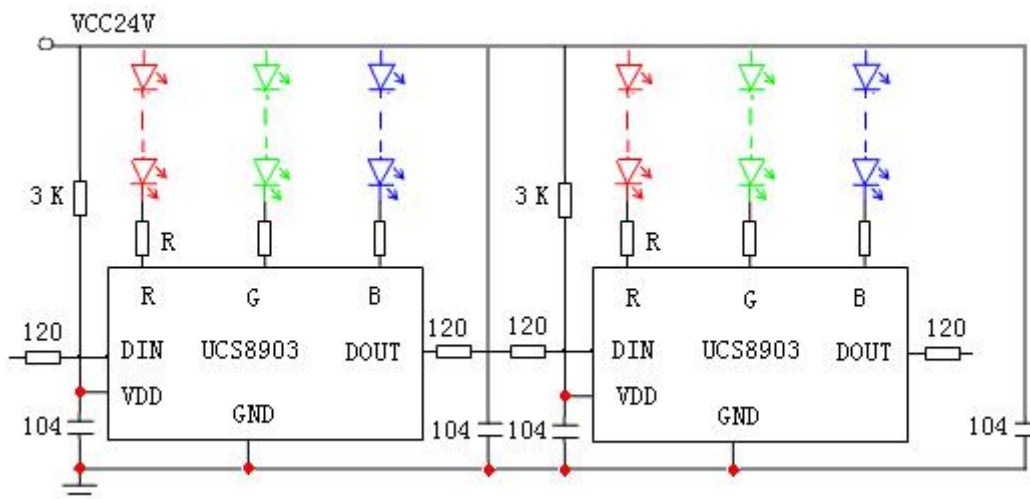
2. Power voltage is 12V

In order to prevent the damage of charged pull plug, when 12 v power supply, Din and Do all the string in a 68-80 ohm resistor for protection

In order to reduce the interference, between each lamps and lanterns of power supply and ground   multiple a capacitance of 104 or 105
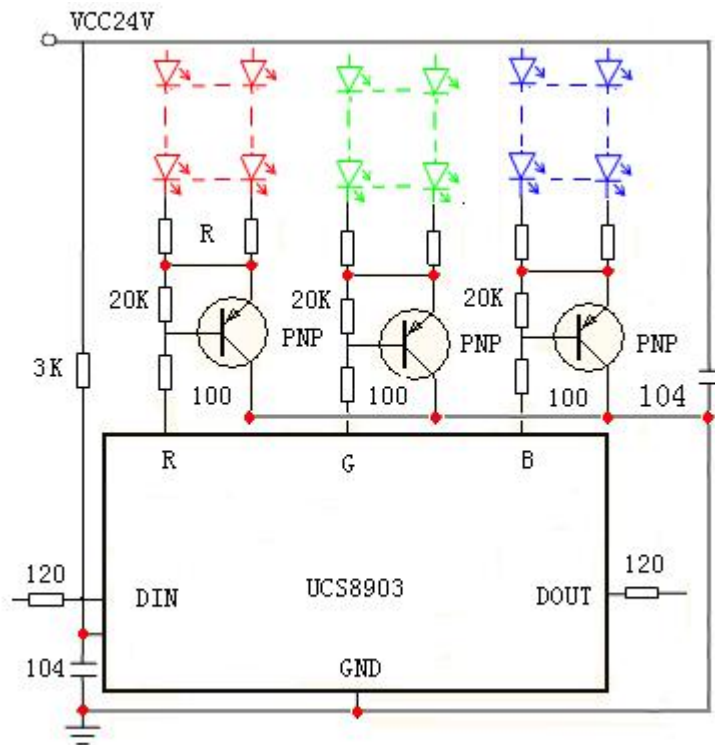
3 . Power voltage is 24V

In order to prevent the damage of charged pull plug, when 24 v power supply, Din and Do all the string in a 120 ohm resistor for protection

In order to reduce the interference, between each lamps and lanterns of power supply and ground   multiple a capacitance of 104 or 105

4. Power voltage is 24V

Attention：Shown above for the PNP transistor，9012,8550 is work

In order to prevent the damage of charged pull plug, when 24 v power supply, Din and Do all the string in a 120 ohm resistor for protection

In order to reduce the interference, between each lamps and lanterns of power supply and ground   multiple a capacitance of 104 or 105

Vds Definition and values

Vds is the output voltage on the RGB pin。In order to avoid more than PD, Vds is no more than 4.5 v .The following formula is Vds：

Vds=VCC-I*R-N*Vled

Attention：I is Each string on the LED current，R is the resistance of LED series，N is the LED   series connection number，Vled is the LED voltage

stabilizing voltage characteristic
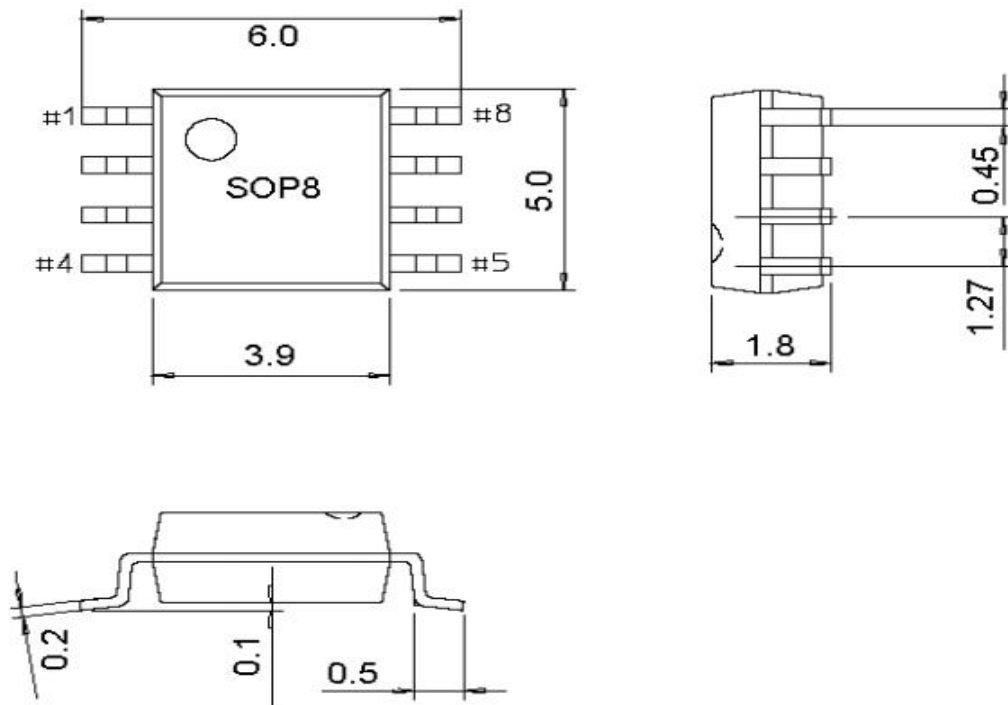
UCS8903 built-in stabilizer, according to the power supply voltage（VCC） is different, must choose different resistance（R） for step-down voltage，Resistance to select in the table below for reference：

VCC (V)	R(ohm)
5	51-80

12	800-1K
15	1.2K-1.5K
24	2.4K- 3K

package outline drawing AND DIMENSION

SOP 8

Version

versions	Issuing date	Revised profile
VER1.0	2010-2-20	The first issue
VER2.0	2011-9-11	Layout Adjustment