

## 3-channel LED display driver

### UCS2903

#### GENERAL DESCRIPTION

The UCS2903 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.

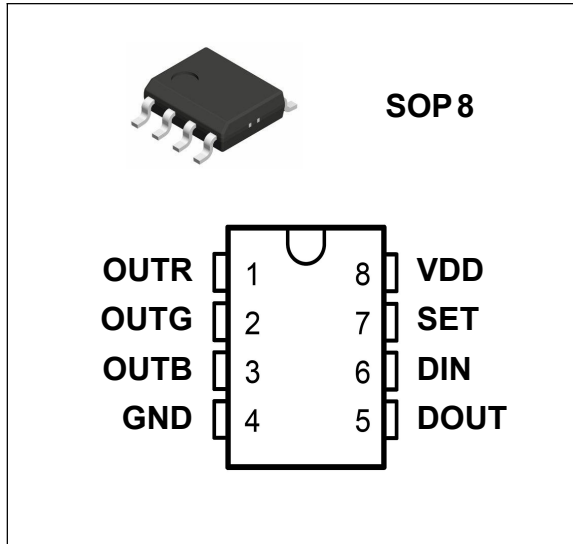
#### FEATURES

1. single line data transmission (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 1024 points can be realized when the refresh rate of 30 frames per second,
5. RGB output port PWM control can be achieved 256 grey level adjustment, port scanning frequency of 1.5 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  $\pm 1.5\%$ , the differences of current between Chip is less than  $\pm 3\%$
8. External different resistance can be change in size of constant current value
9. when power up ,IC self-inspection then Light connection on the pin B lamp
10. SA-I Anti-interference patent technology for single line data transmission
11. Industrial design, stable and reliable

#### Application:

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

## PIN CONFIGURATION



## 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	SET		Connect the external resistance to the ground to change different constant current output value, suspend in midair to 17 mA
8	VDD		Logic power supply

**ABSOLUTE MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$ ,  $V_{SS} = 0\text{V}$ , 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	$^\circ\text{C}$
Storage temperature	$T_{STG}$	-55 to +150	$^\circ\text{C}$
antistatic	ESD	6000	V
output rating	Pd	400	mW

**RECOMMENDED OPERATING RANGES** ( $T_A = -20$  to  $+70^\circ\text{C}$ ,  $V_{SS} = 0\text{V}$ , 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	$V_{out}$	24			V

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

Parameter	Symbol	Min.	Typ.	Max	Unit	Test conditions
Low level output current	$I_{out}$	16.5	17	17.5	mA	R, G, B (SET not connected)
Low level output current	$I_{sink}$	50			mA	R, G, B
Low level output current	$I_{do}$	10	-	-	mA	$V_o = 0.4\text{V}$ , $D_{out}$
High level input voltage	$V_{ih}$	$0.6V_{dd}$	-		V	
Low level input voltage	$V_{il}$	-	-	$0.3V_{dd}$	V	
Voltage hysteresis	$V_h$	-	0.35	-	V	
quiescent current	$I_{DDdyn}$			1	mA	无负载
rated power	PD			250	mW	( $T_a = 25^\circ\text{C}$ )
thermal resistance	$R_{th(j-a)}$		80	190	$^\circ\text{C}/\text{W}$	

**SWITCHING CHARACTERISTICS** ( $T_A = -20$  to  $+70$  °C,  $V_{DD} = 4.5$  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	-

### Constant current output value

RGB Output current can be adjusted through SET connected different resistance( $R_S$ ) to the ground. Output current is 17mA when SET is not connected. (Output current maximum to more than 60 mA)

电流调节	Vds 最小值	参考电阻值
17mA	0.6V	悬空
20mA	0.7V	20K
23mA	0.8V	10k
25mA	0.9V	6.8K
35mA	1.5V	3.3k
42.5mA	2.2V	2K
50mA	3V	1.5k

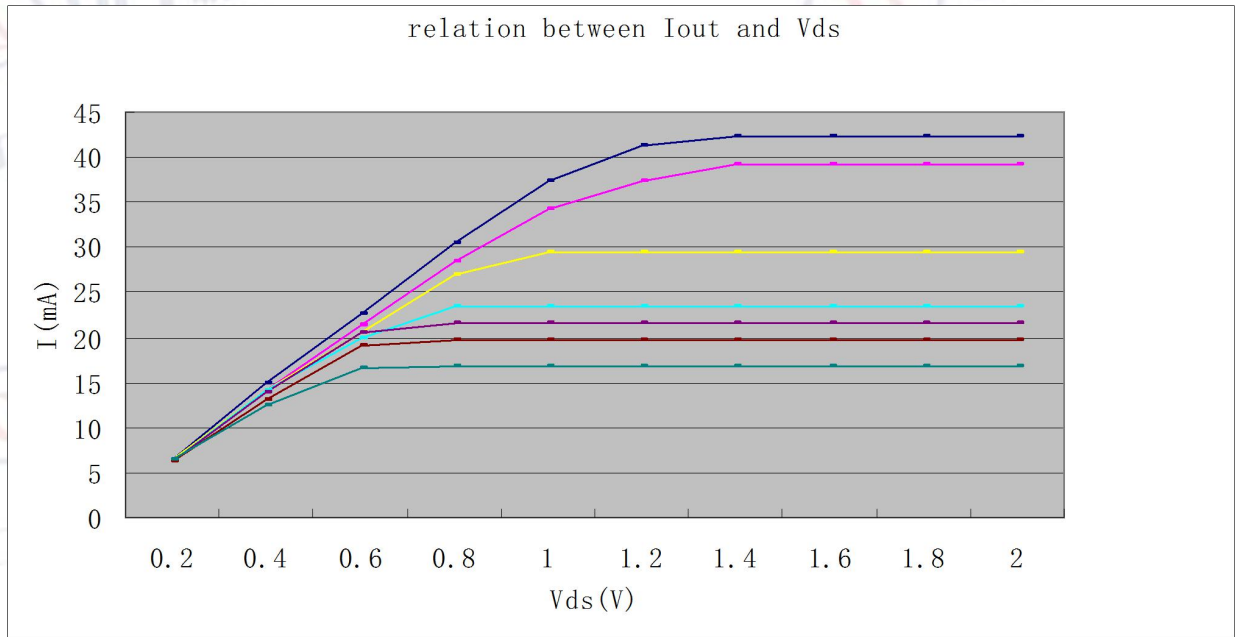
### constant current characteristic

UCS2903 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  $\pm 1.5\%$ . the differences of current between Chip is less than  $\pm 3\%$

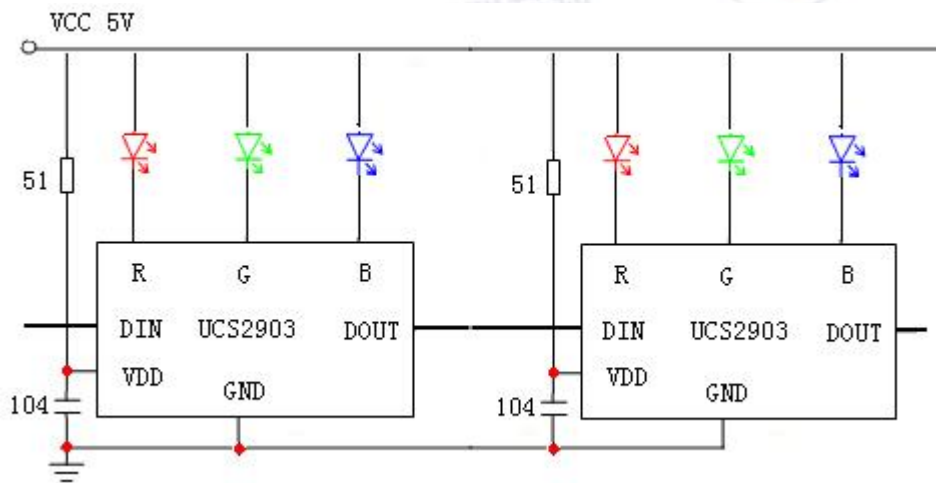
(2): When the voltage of the load change, UCS2903 output current is not affected, as shown in the figure below

(3): Below UCS2903 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.



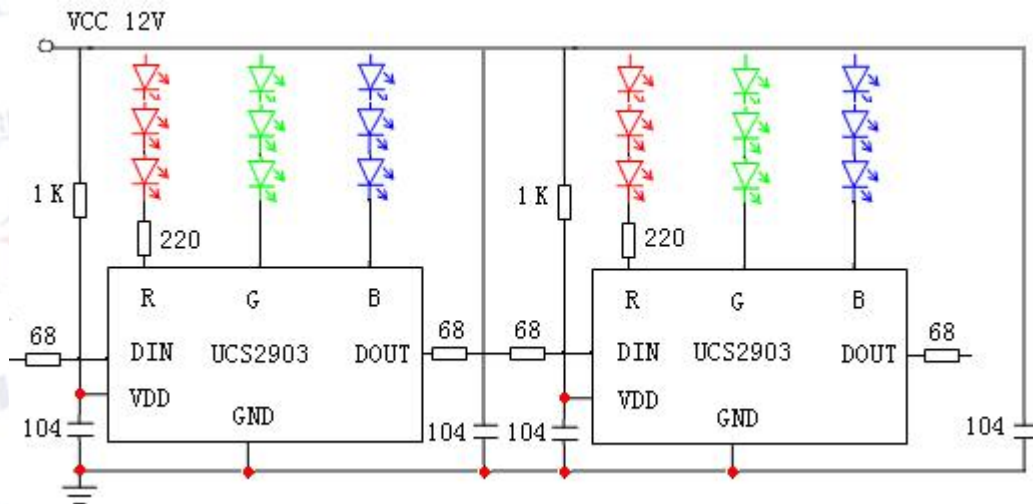
### Typical Application circuit diagram

#### 1. Power voltage is 5V



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

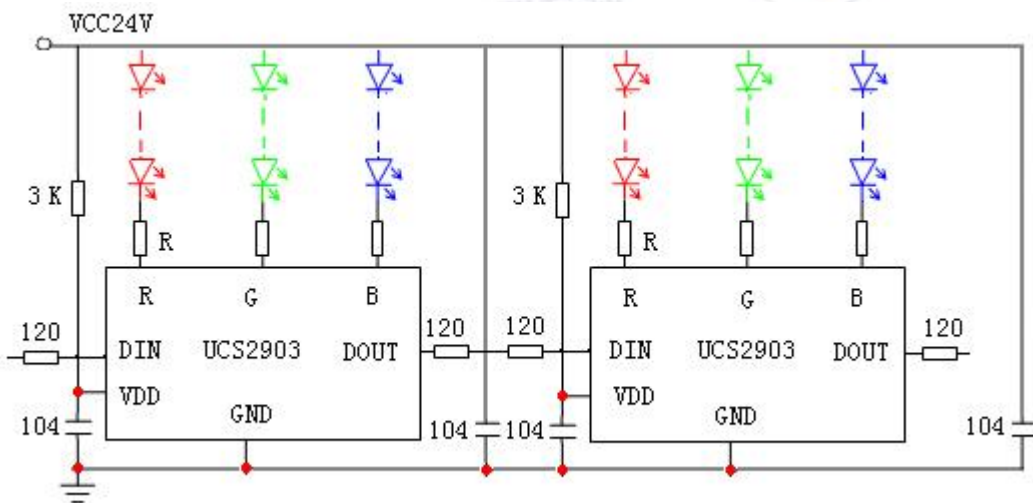
#### 2. Power voltage is 12V



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

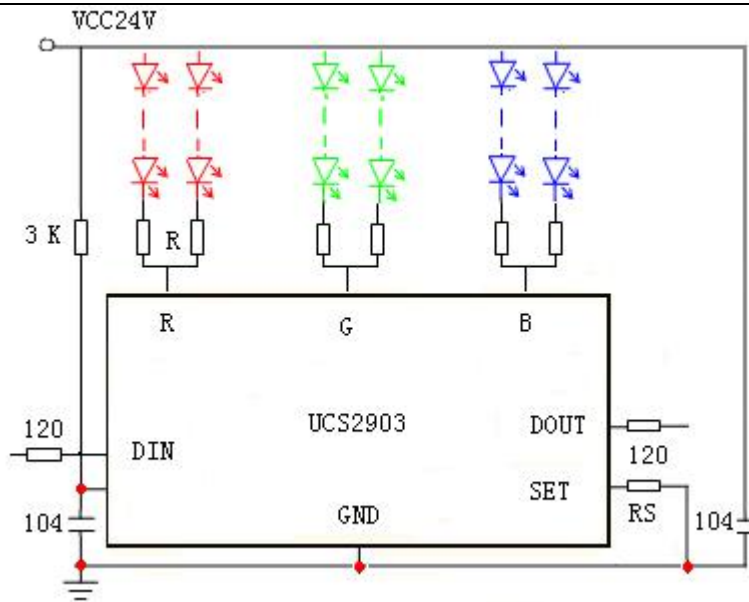
### 3. Power voltage is 24V



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

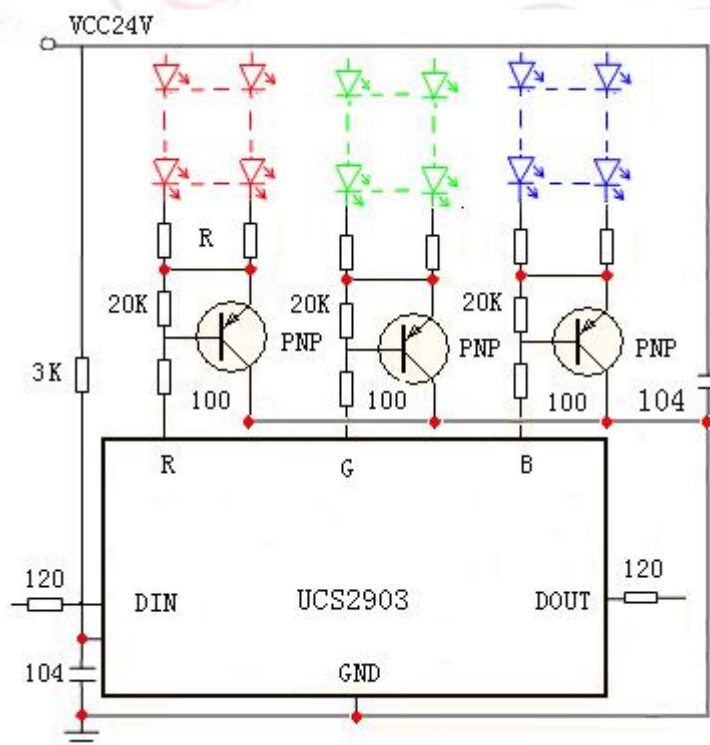
### 4. Power voltage is 24V



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

5. 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 v when 20mA and no more than 2.5V when 40mA, 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

UCS2903 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:

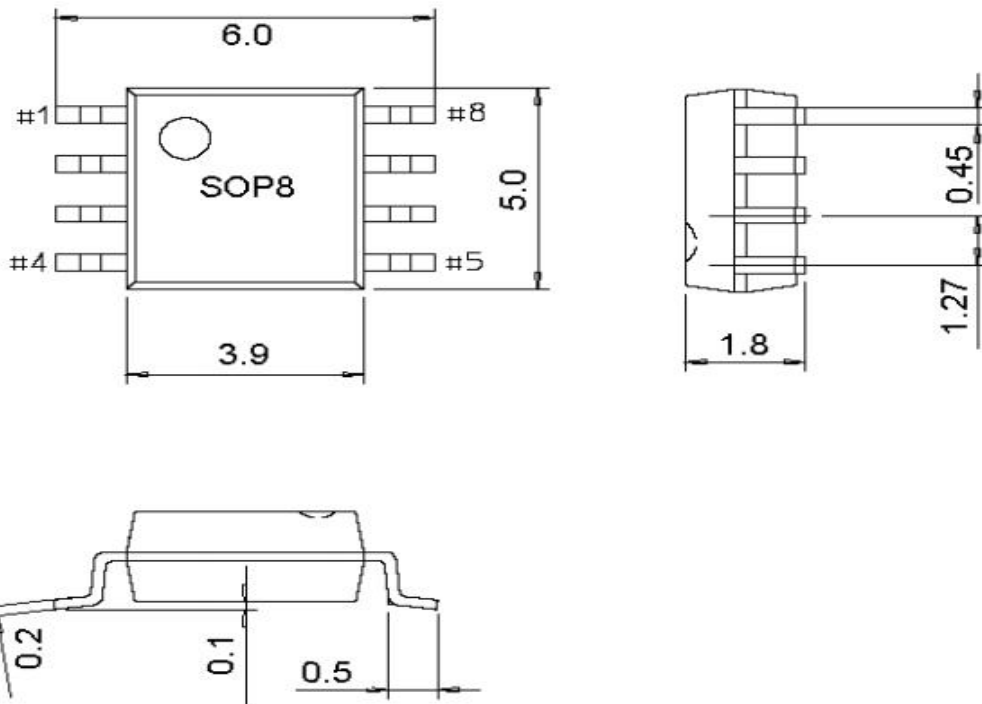
VCC (V)	R(ohm)
5	51-80
12	750-1K
15	1.2K-1.5K
24	2.4K- 3K

In practical applications, the VDD voltage is constant at about 5V. When the SET pin is connected to high level, it should be connected to VDD. It should not be connected to external Power supply VCC, so as to prevent chip breakdown.

### package outline drawing AND DIMENSION

SOP 8





### Version

versions	Issuing date	Revised profile
VER1.0	2010-3-25	The first issue
VER2.0	2011-9-11	Layout Adjustment