

high gray scale display 4-channel LED constant current driver

UCS8904A

GENERAL DESCRIPTION

The UCS8904A is a 4-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.

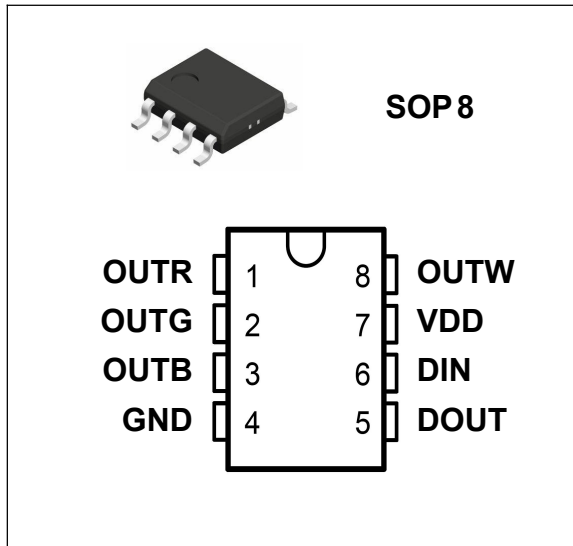
FEATURES

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 512 points can be realized when the refresh rate of 25 frames per second,
5. 4 PWM output port, easy to control 4 color LED products, Commonly used in RGBW color LED control
6. RGBW output port PWM control can be achieved 65536 grey level each port adjustment, port scanning frequency of 4 KHz/s
7. chip VDD built-in 5 v voltage regulator tube, output port Withstand Voltage is greater than 24 V
8. 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 $\pm 3\%$
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 | VDD | | Logic power supply |
| 8 | OUTW | LED drive output | White PWM control output |

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^\circ\text{C}$, $V_{SS} = 0\text{V}$, 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 $+70\text{ }^\circ\text{C}$, $V_{SS} = 0\text{V}$, 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 | Vout | 24 | | | V |

ELECTRICAL CHARACTERISTICS ($T_A = -20$ to $+70\text{ }^\circ\text{C}$, $V_{DD} = 4.5$ to 5.5V , $V_{SS} = 0\text{V}$, 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, W |
| Low level output current | I _{do} | 10 | - | - | mA | $V_o = 0.4\text{V}$, Dout |
| 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 | ($T_a = 25\text{ }^\circ\text{C}$) |
| thermal resistance | R _{th(j-a)} | | 80 | 190 | $^\circ\text{C/W}$ | |

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 → DOOUT, $R_L = 10$ 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 | - |

64-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 |
| W15 | W14 | W13 | W12 | W11 | W10 | W9 | W8 | W7 | W6 | W5 | W4 | W3 | W2 | W1 | W0 |

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

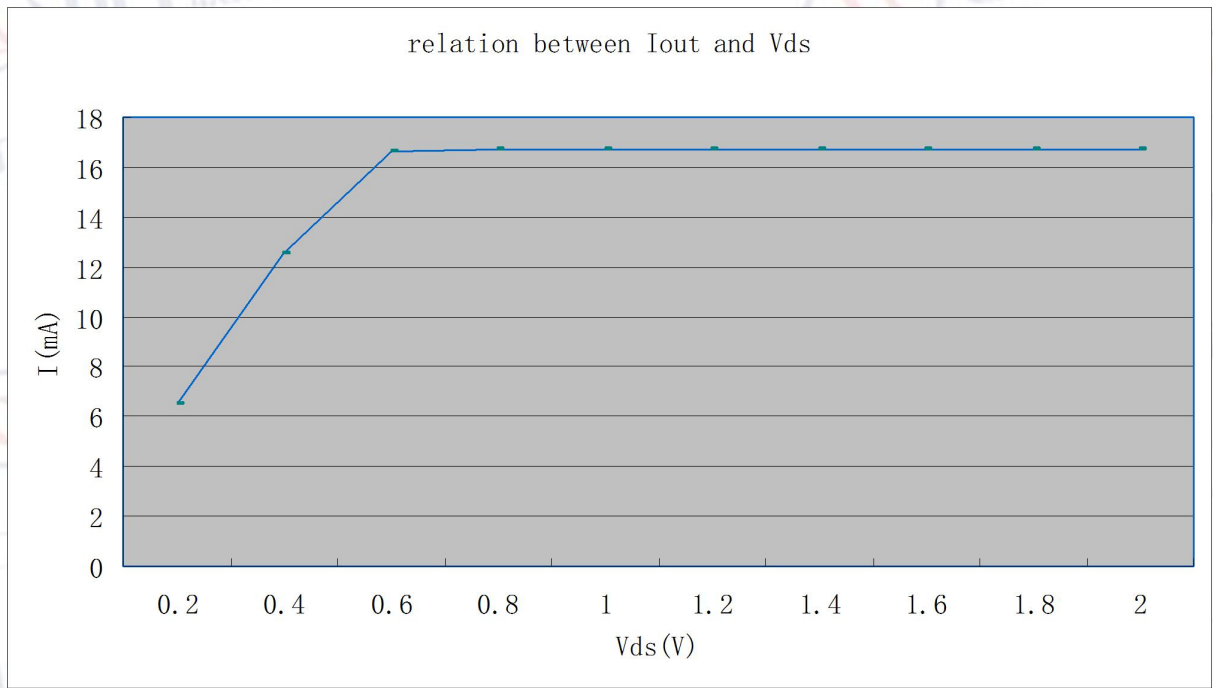
constant current characteristic

UCS8904A 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 $\pm 3\%$

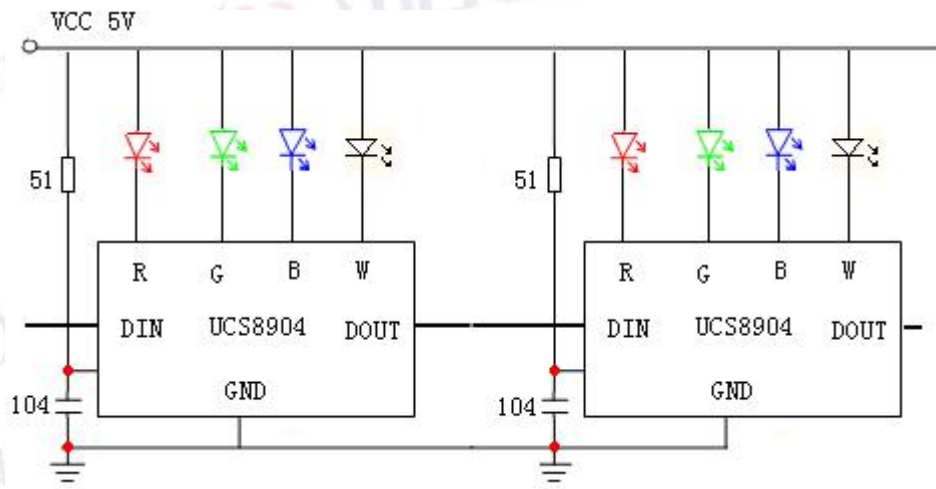
(2): When the voltage of the load change, UCS8904A output current is not affected, as shown in the figure below

(3): Below UCS8904A 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.



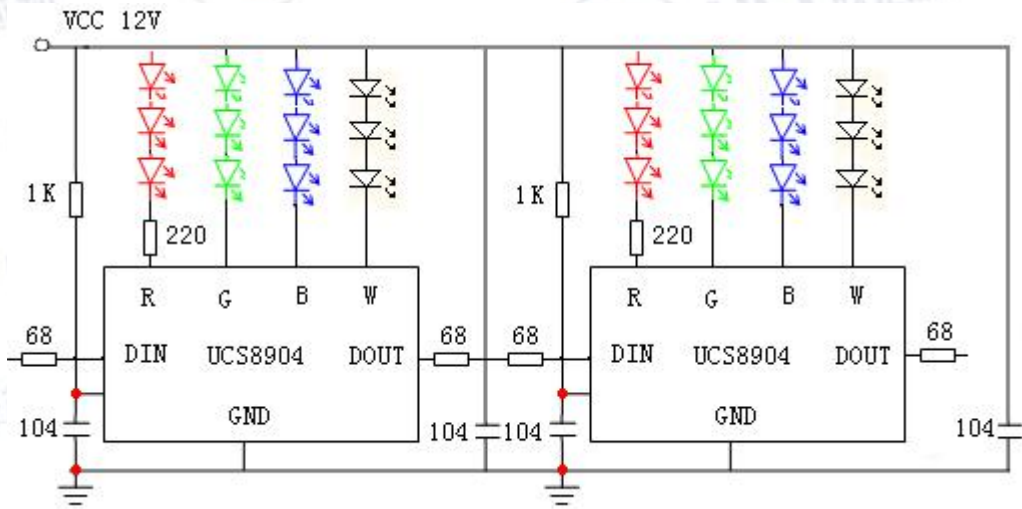
Typical Application circuit diagram

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.

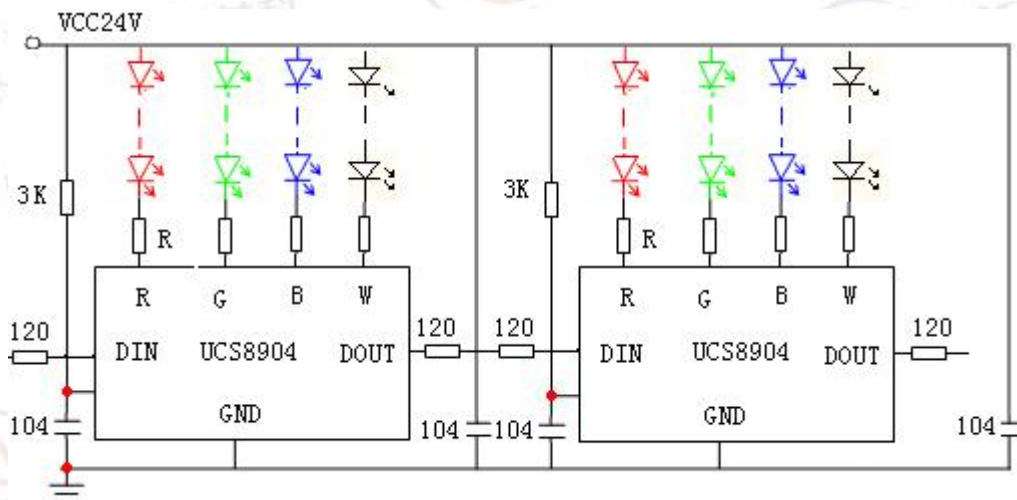
2. Power voltage is 12V



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

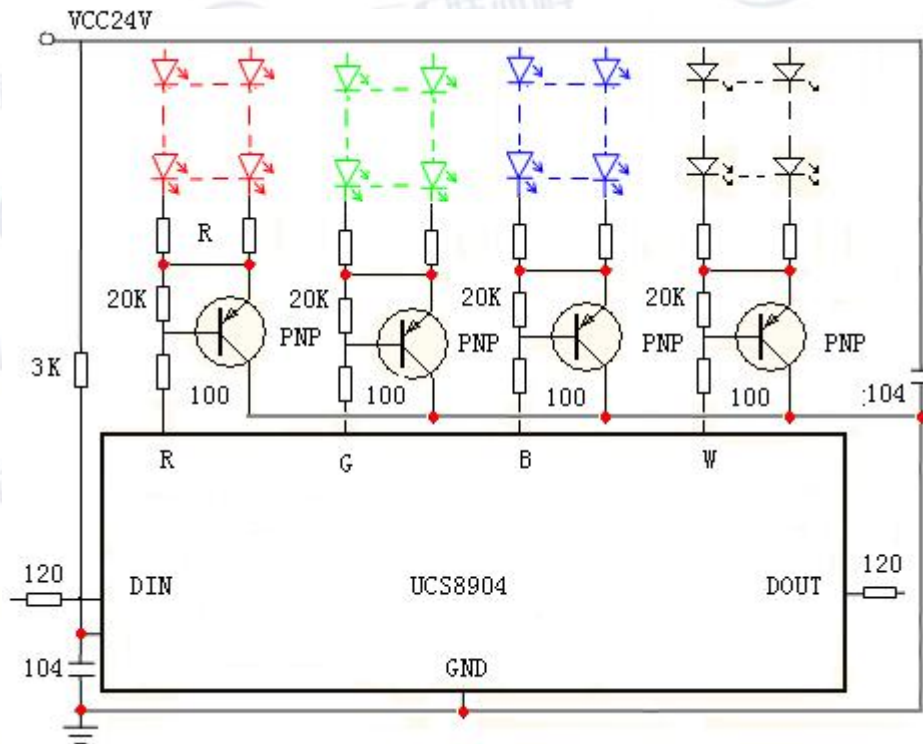
3. Power voltage is 24V



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



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 3.5 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

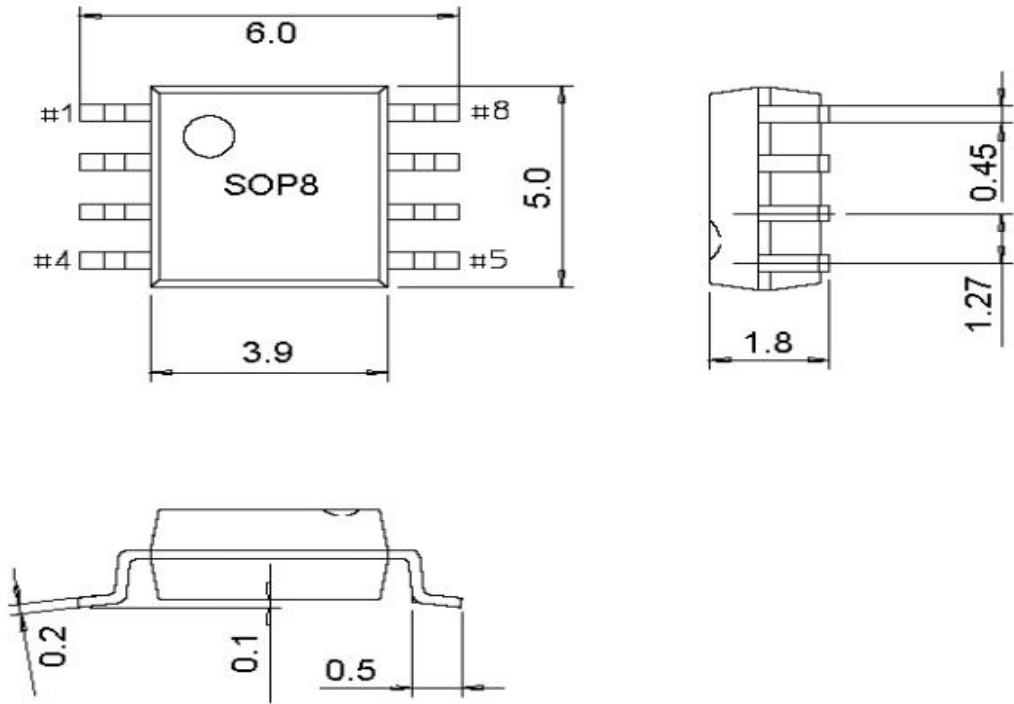
stabilizing voltage characteristic

UCS8904A built-in stabilizer, according to the power supply voltage (VCC) is different, must choose different resistance (VR) for step-down voltage, Resistance to select in the table below for reference:

| VCC (V) | VR(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 |