4-channel high-level grayscale LED drive control circuit UCS8904B

Product Description

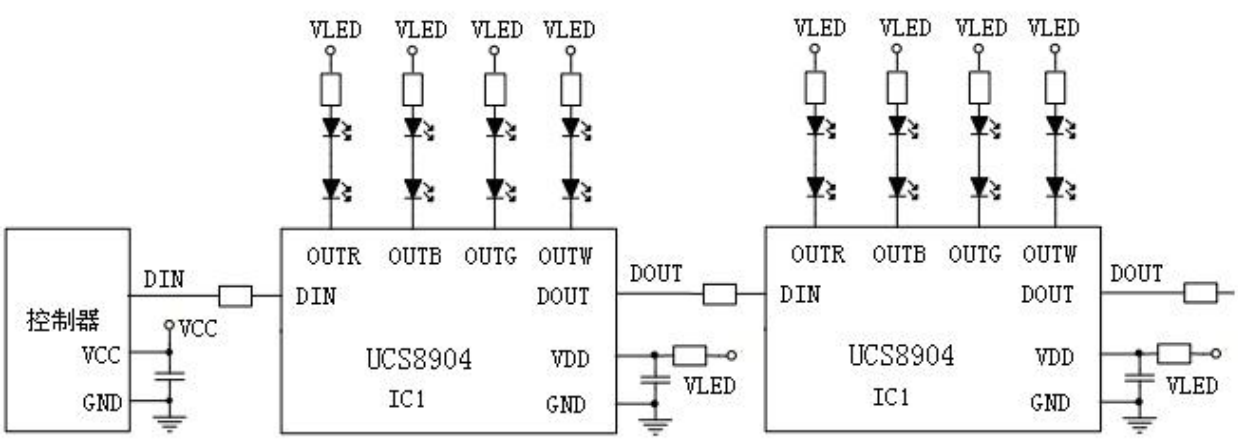
UCS8904B is a dedicated circuit for 4-channel LED high-level grayscale cascade drive control, which realizes the full-color effect of outdoor large-screen high-level grayscale through peripheral MCU control. It adopts a variety of patented technologies to strengthen the protection against high-voltage shock and static electricity while strengthening the performance indicators. At the same time, it also adds a variety of anti-interference technologies, which is very suitable for projects with high stability requirements.

Main Features

- Single-wire data transmission, unlimited cascading
- Reshaping and forwarding enhanced technology, the transmission distance between two points is more than 10 meters
- 65536 levels of true gray, using high-level gray realization technology, port scanning frequency 4KHz/s
- The data transmission rate is 800K/S, and the frame rate of picture refresh can be 60 frames (200 points), 30 frames (400 points)
- Power-on self-test blue light function
- The chip VDD has a built-in 5V voltage regulator tube, and the output port withstand voltage is 28V
- S-AI single-wire transmission anti-interference patented technology, which can greatly reduce and filter out radiation interference and conduction interference
- Use preset 18mA/channel constant current mode. High constant current accuracy, inter-chip error <±5%.
- Electrostatic and surge protection enhancement technology

Application Field

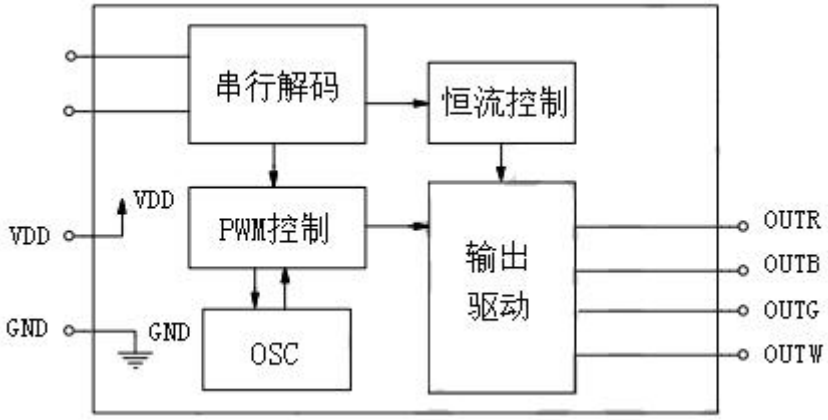
Point light source, line light, flexible light bar, indoor and outdoor screens, etc.



4-channel high-level grayscale LED drive control circuit UCS8904B

Footprint（SOP8）

Internal functional block diagram:



Pin Description:

	UCS8904B	
Number	Symbol	Function Description
1	OUTR	Red PWM control output
2	OUTG	Green PWM control output
3	OUTB	Blue PWM control output
4	GND	Ground
5	DOUT	Display data cascade output (800K)
6	DIN	Display data input (800K)
7	VDD	power supply
8	OUTW	White PWM control output

4-channel high-level grayscale LED drive control circuit UCS8904B

Maximum rating (If no special instructions, T_A = 25℃, V_{SS} = 0V)

Parameter	Symbol	Scope	Unit
Logic power supply voltage	Vdd	6.5	V
Output port withstand voltage	Vout	30	V
Logic input voltage	Vi	-0.5～Vdd+0.5	V
Operating temperature	Topt	-40～+85	℃
Storage Temperature	Tstg	-55～+150	℃
Anti-static	ESD	8000	V
Rated output power	Pd	400	mW

Recommended scope of work (if no special instructions, Ta= -40～+85℃, Vss= 0V)

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
Logic power supply voltage	Vdd	-	5.5	-	V	-
High-level input voltage	Vih	0.7Vdd	-	Vdd	V	-
Low-level input voltage	Vil	0	-	0.3Vdd	V	-
Output port withstand voltage	Vout		28		V	

Electrical parameters (if no special instructions, Ta= -40～+85℃, Vss= 0V, Vdd= 4.5～5.5V)

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
Low-level output current	Iout	-	18		mA	R, G, B, W
Low-level output current	Ido	10	-	-	mA	Vo =0.4V, Dout
Input Current	Ii	-	-	±1	μA	
High-level input voltage	Vih	0.7Vdd	-		V	D_{IN}, SET
Low-level input voltage	Vil	-	-	0.3Vdd	V	D_{IN}, SET
Lagging voltage	Vh	-	0.35	-	V	D_{IN}, SET
Current offset (between channels)	dIout		±1.5	±3.0	%	Vds=1V, Iout=17mA
Current offset (between chips)	dIout		±3.0	±5.0	%	Vds=1V, Iout=17mA
Current offset VS-Vds	%dVds		±0.1	±0.5	%/V	1V<Vds<3V
Current offset VS-Vdd	%dVds		±1.0	±2.0	%/V	4.5V<Vdd<5.5V
Dynamic current consumption	IDDdyn	2		3	mA	DO 关闭
Power Consumption	PD		300		mW	(Ta=25℃)
Thermal resistance	Rth(j-a)	80		190	℃/W	

4-channel high-level grayscale LED drive control circuit UCS8904B

Switching characteristics (if no special instructions, Ta= -40～ + 85℃, Vss= 0V, Vdd= 4.5～ 5.5V)

Parameter	Symbol	Minimum	Typical	Maximum	Unit	Test Conditions
Oscillation frequency	FOSC1	-	800	-	KHz	Vdd =5V
	FOSC2	-	100	-	MHz	Vdd =5V
Transmission delay time	Tflz	-	-	300	ns	C1= 15pF, D_{IN} → D_{OUT}, R1 = 10kΩ
Fall Time	Tthz	-	-	120	μs	C1 = 300pF, OUTR/OUTG/OUTB
Data transfer rate	Fd	800	-	-	Kbps	Duty Cycle 50%
Input capacitance	Ci	-	-	15	pF	-

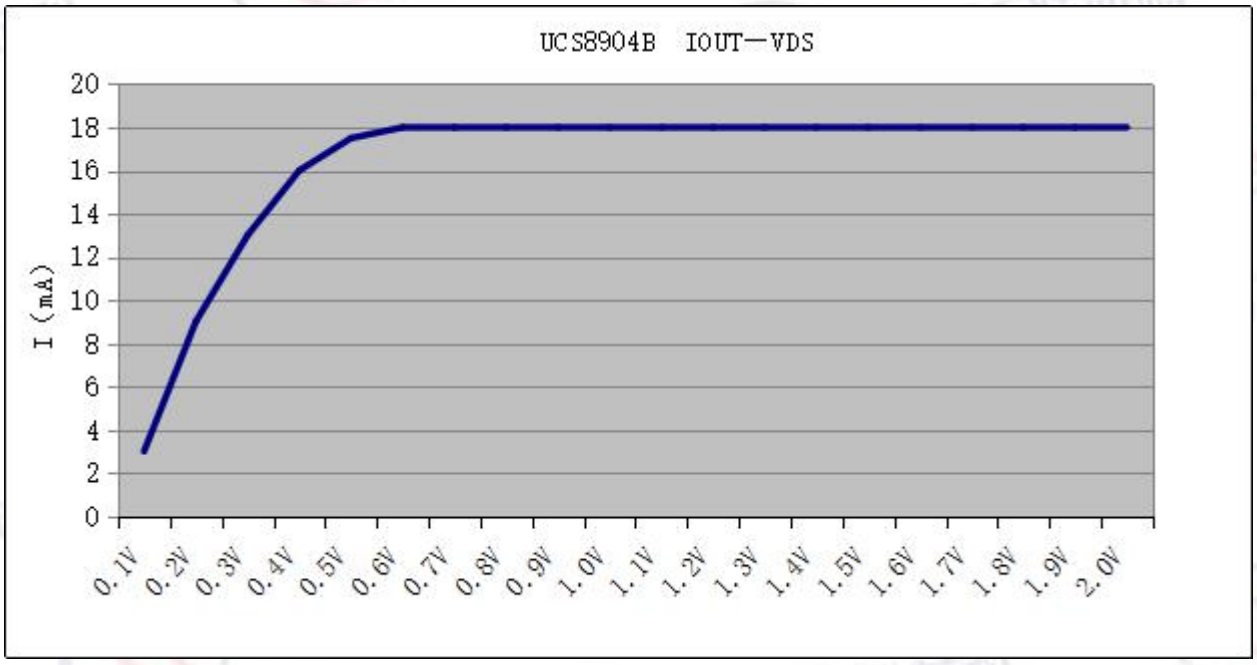
Constant current curve

UCS8904B has excellent constant current characteristics, and the current difference between channels and even between chips is extremely small.

(1): The maximum current error between channels is up to ±2%, and the maximum current error between chips is up to ±5%.

(2): When the load terminal voltage changes, the UCS8904B output current is not affected.

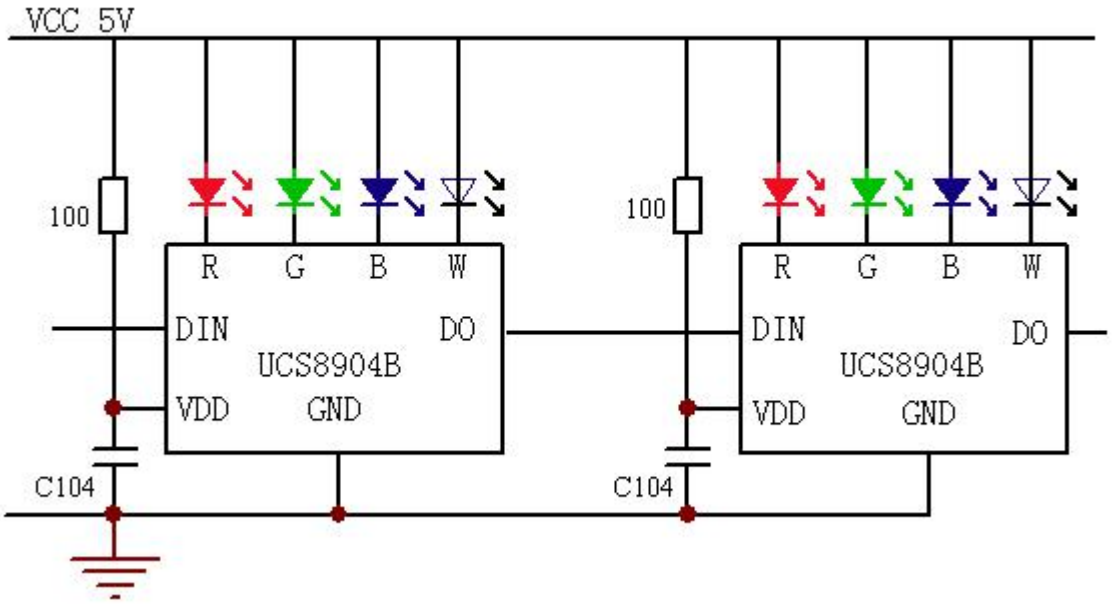
(3): As shown in the figure below, the Vds of the UCS8904B output port is 0.6V



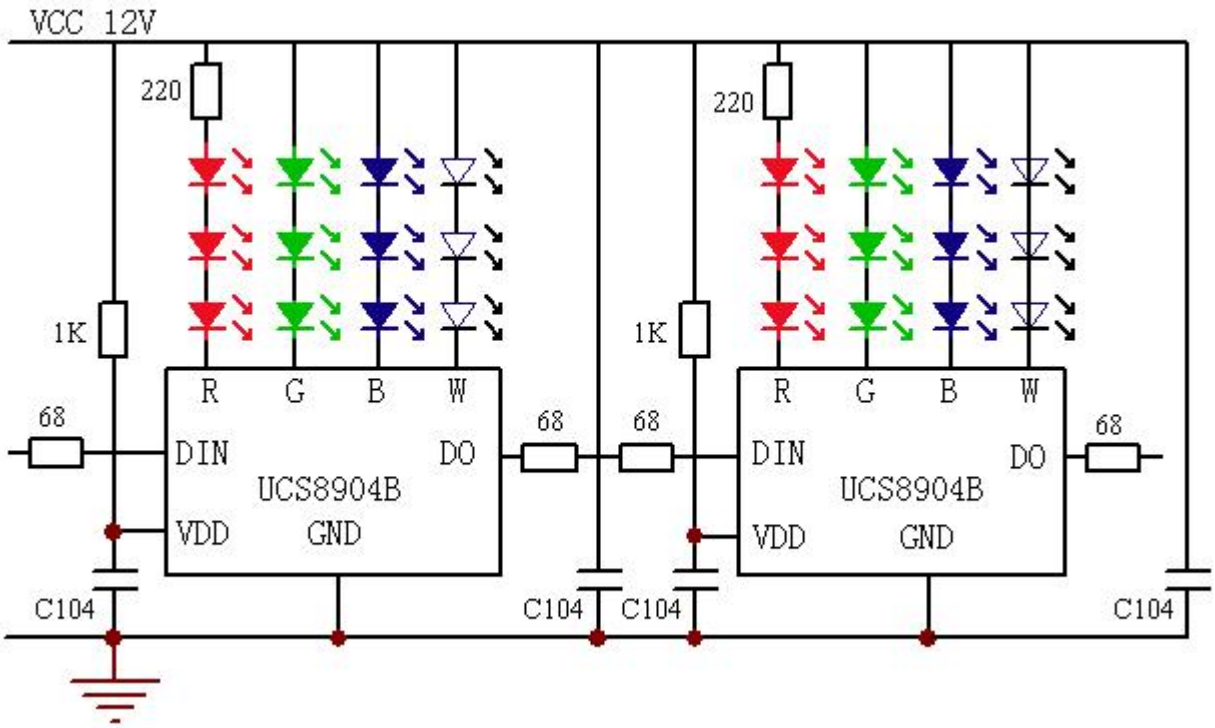
4-channel high-level grayscale LED drive control circuit UCS8904B

Application circuit diagram

1. 1. Power supply voltage 5V, with a single LED



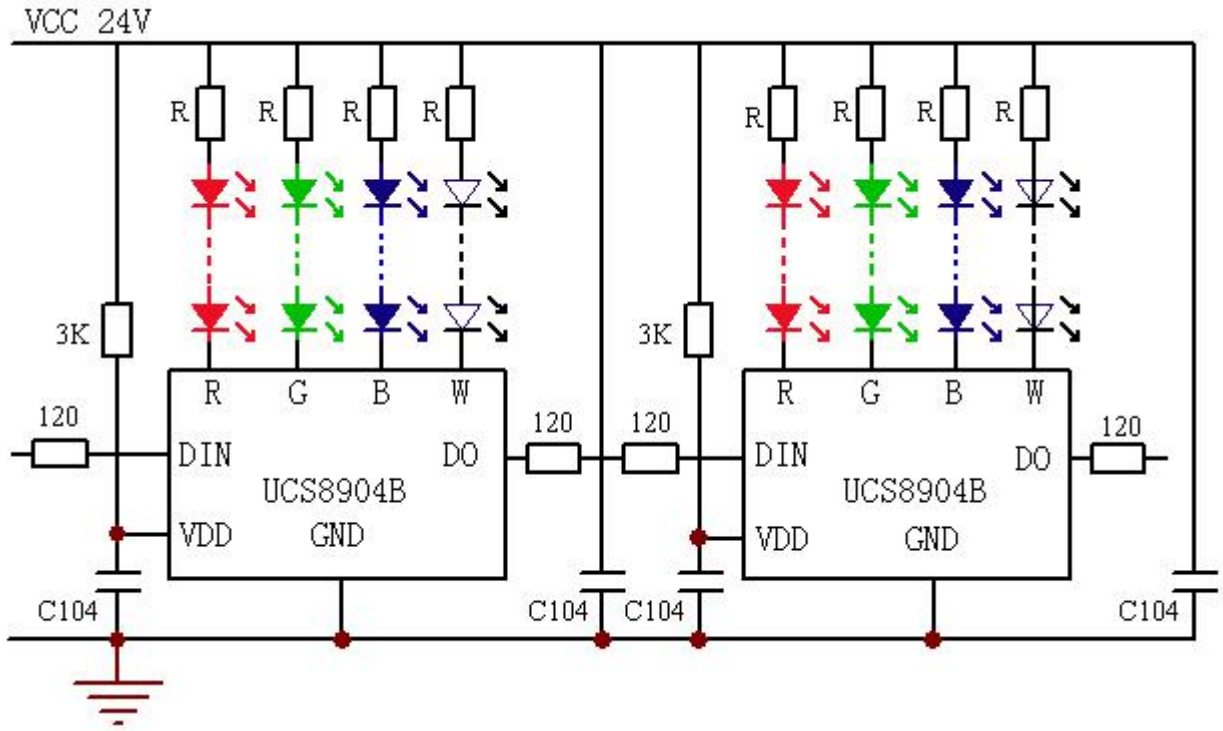
2. Application diagram of power supply voltage 12V, 3 LEDs per string



4-channel high-level grayscale LED drive control circuit UCS8904B

1. When the 12V power supply is used, it is recommended to connect a 68 ohm resistor to the signal input and output terminals of the IC to prevent damage to the input and output terminals of the IC under conditions such as live plugging or plugging or reverse connection of power and signal lines.
2. A high-frequency capacitor with a capacitance of 104 or above should be connected in parallel between the power supply (12V) and the ground to reduce the interference caused by current

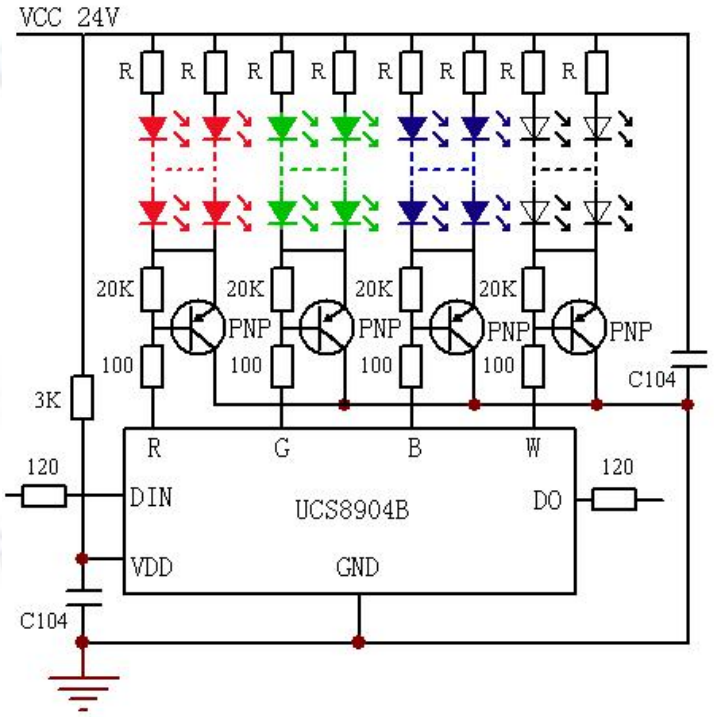
3. Power switching. Voltage 24V, control 4~6 string LED lights application



1. When the 24V power supply is used, it is recommended to connect a 120 resistance to the signal input and output terminals of the IC to prevent damage to the input and output terminals of the IC under the conditions of live plugging or plugging or reverse connection of power and signal lines.
2. A high-frequency capacitor with a capacitance of 104 or above should be connected in parallel between the power supply (24V) and the ground to reduce the interference caused by the current switch.

4-channel high-level grayscale LED drive control circuit UCS8904B

4. Power supply voltage 24V, control (2 parallel and above) × (4 ~ 6) string LED lights above the application diagram (non-constant current application):



Note: PNP is used for triode, conventional 9012, 8550, etc. can be used.

1. When the 24V power supply is used, it is recommended to connect a 120 resistance to the signal input and output terminals of the IC to prevent damage to the input and output terminals of the IC under the conditions of live plugging or plugging or reverse connection of power and signal lines.
2. A high-frequency capacitor with a capacitance of 104 or above should be connected in parallel between the power supply (24V) and the ground to reduce the interference caused by the current switch.

Voltage stabilization characteristics

UCS8904B can be configured to supply power with a voltage of 6~24V. The 104P capacitor between the power supply and the ground should be as close to the IC body as possible, and the circuit should be as close as possible. The IC has a built-in voltage regulator tube, but according to different input voltages, different power supply resistance R should be configured. The resistance value list is as follows:

Voltage	It is recommended to connect a resistor between the power interface and VDD
5V	100Ω
12V	750Ω-1KΩ
24V	2.4KΩ—3KΩ

Note: A larger value of power supply resistance can reduce power consumption, but it will also reduce the distance between ICs. A smaller value of power supply resistance increases power consumption.

But it will increase the cable distance between ICs.

4-channel high-level grayscale LED drive control circuit UCS8904B

Voltage divider resistance

Power consumption calculation, if the voltage drop (Vds) of each output pin of the IC is set to 4V, the power consumption at the highest gray scale output on the IC is:

P=PRGB+PVDD=4*4V*18mA+5V*10mA=0.288+0.05=0.335W

The following table shows the maximum recommended Vds Vds-max (calculated based on the maximum power consumption of 350mW) when the ambient temperature is 25℃ and the double-sided thin fiber board is used. max(.

	4 Channel Output
I（mA）	18
Vds-max（V）	4

Note 1: The maximum power consumption is not a fixed value, it is proportional to the heat dissipation capacity of the lamp. Lamp power, etc. will affect the maximum power consumption, and the ambient temperature also has a greater impact on the maximum power consumption.

Note 2: High-temperature aging test of the finished product must be done for applications with high power consumption (high temperature test environment is recommended to be greater than 30% of the actual maximum ambient temperature) Note 3: In the power calculation process, the discreteness of the turn-on voltage of the lamp must be considered. Especially when the turn-on voltage of the lamp beads has a large dispersion and the number of series connections in the case of a large amount.

Voltage divider resistance calculation:

VCC—N*Vled-min—VR < Vds-max

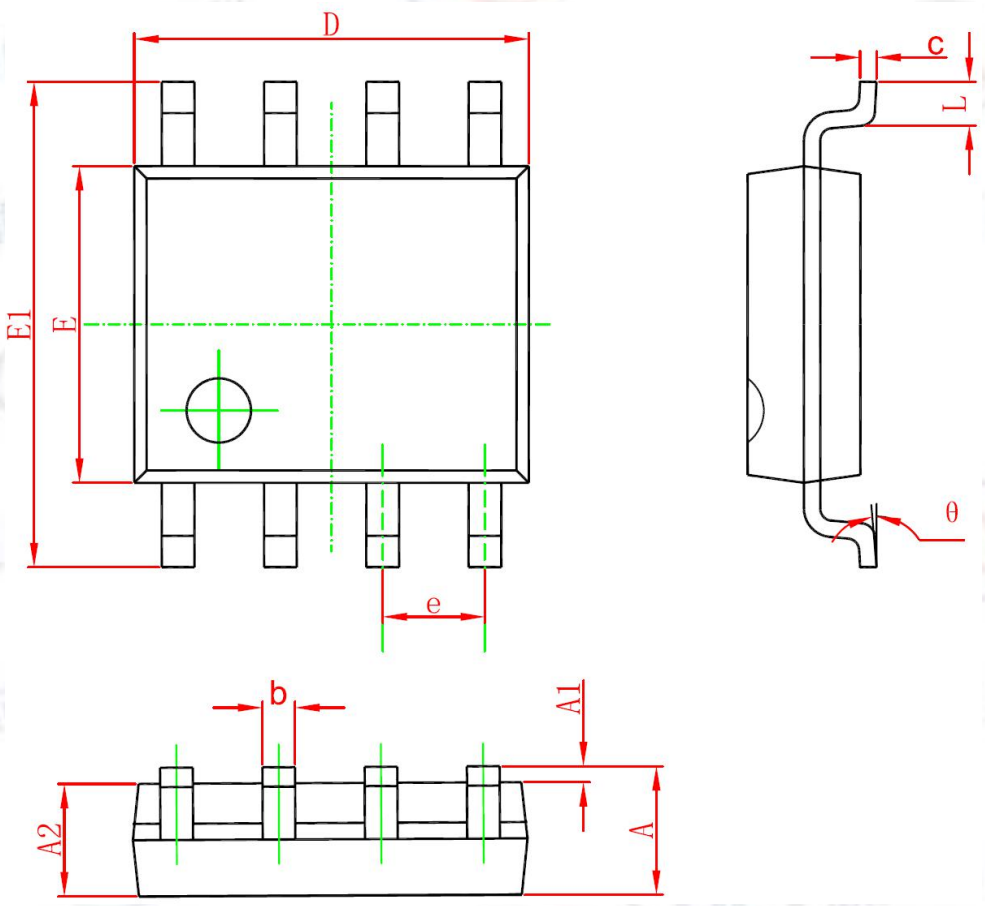
VR=I*R R Refers to the voltage divider resistance

R > （VCC—-N*Vled-min—Vds-max)/I

VCC refers to the power supply voltage, Vled-min is the minimum turn-on voltage of the lamp beads, N refers to the number of lamp beads in series, Vds-max refers to the maximum voltage of each output pin, and I refers to the set constant current value.

Package outline drawing and size

SOP8



Symol	mm		inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

4-channel high-level grayscale LED drive control circuit UCS8904B

Version Number

Version	Issue Date	Revision Introduction
VER1.0	2018-3-25	First edition
VER1.1	2012-8-14	Content modification