3-channel LED display driver

UCS1903N

GENERAL DESCRIPTION

The UCS1903N 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.

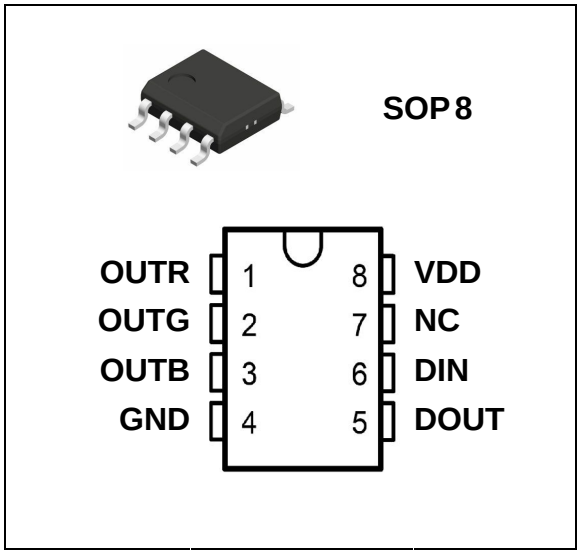
FEATURES

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 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 ±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



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} = 0V, 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} = 0V, 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 5.5V, V_{SS} = 0V, 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 ＝ 0.4V，Dout
High level input voltage	Vih	0.6Vdd	-		V	
Low level input voltage	Vil	-	-	0.3Vdd	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 5.5V, V_{SS} = 0V, 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	-

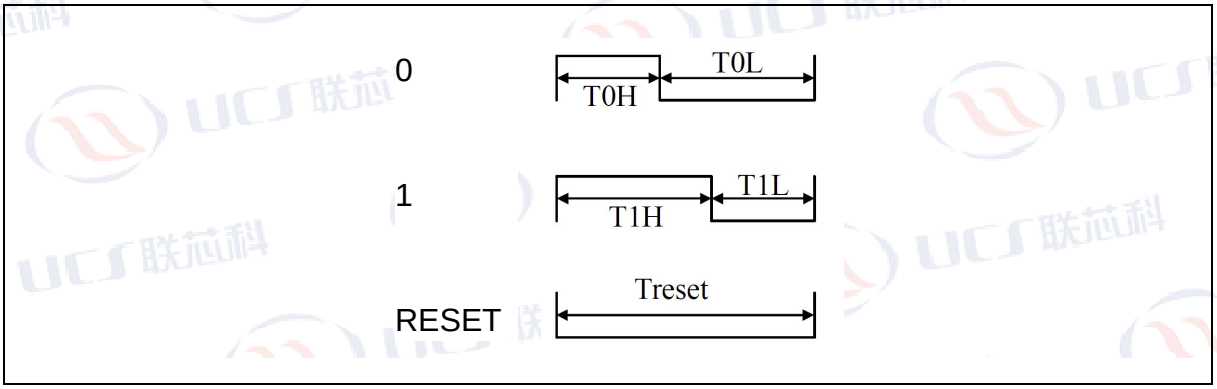
FUNCTIONAL DESCRIPTION

The UCS1903N sends signals in return to zero codes with a single-wire communication method. When the power-on reset is completed, the UCS1903N receives the data from the DIN pin. When all the 24 bits of data have been received, IC no longer receive data ， the DOUT port starts to forward the data to the next chip as its input data. The DOUT pin is held LOW before the data forwarding,. The three PWM output ports, OUTR, OUTG and OUTB, drive Duty ratio output in a 0.6-ms period corresponding to the 24-bit data received before。If the input data from the DIN pin is a RESET code , the UCS1903N will drive the newest received 24-bit data for display. When the reset code is completed, the UCS1903N will start receive the new 24-bit data. When 24 bits of data have been received, the UCS1903N will forward the data through the DOUT pin. Before the RESET signal is received, the output at the OUTR, OUTG and OUTB pins will remain unchanged. When a low level RESET code longer than 24μs is received, the UCS1903N will drive Duty ratio output corresponding to the newest 24-bit data received

The UCS1903N employs an automatic shaping-forwarding technique, so the number of the cascaded chips is not limited by the signal transfer, and is only limited by the panel refresh speed. For example, in a 1024-chip cascaded design with the panel refresh time of 1024X3X8 X 1.25（us）=30ms), no flickering will appear.

TIMING WAVEFORMS

1 Input code



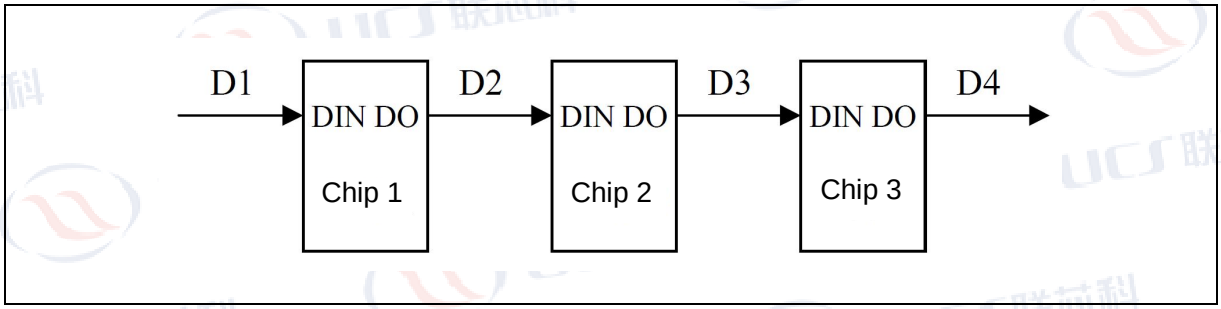
2 code time of IC forward

Name	Description	Typ. value	error
T0H	0 code, up level time	0.4μs	±40ns
T1H	1 code, up level time	0.8μs	±80ns
T0L	0 code, Low level time	0.8μs	±80ns
T1L	1 code, low level time	0.4μs	±40ns
Reset	Reset code, Low level time	>24us	

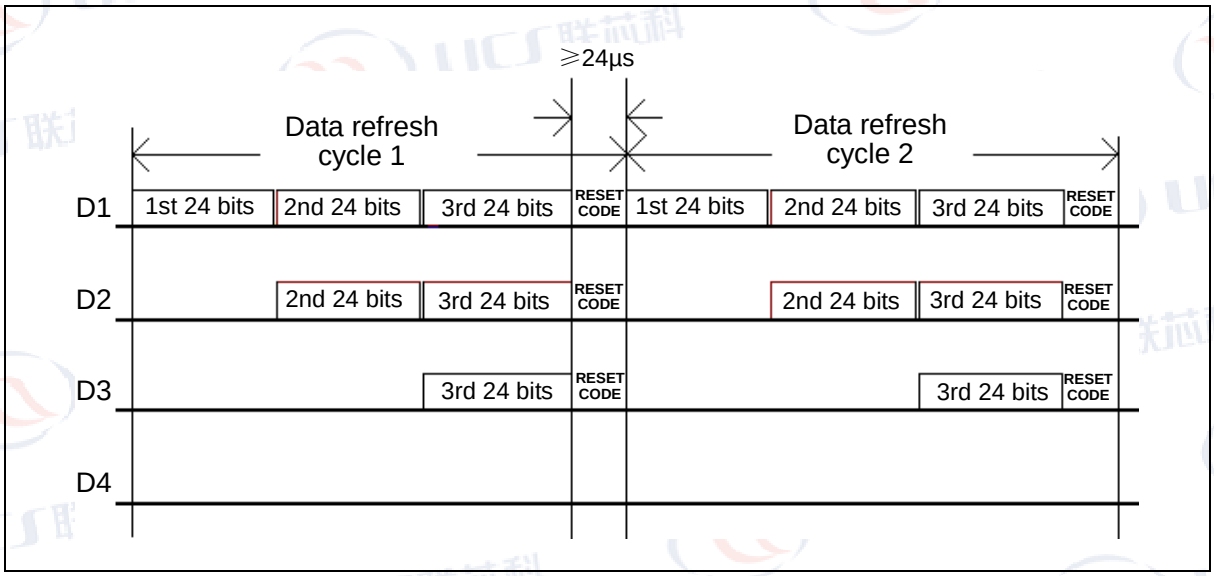
3. code time of controller send

Name	Description	Typ. value	
T0H	0 code, up level time	0.4μs	
T1H	1 code, up level time	0.8μs	
T0L	0 code, Low level time	0.9μs	
T1L	1 code, low level time	0.5μs	
Reset	Reset code, Low level time	>24us	

4 Connection scheme



5 Data transfer format



Note: D1 is the data sented from the MCU, D2, D3 and D4 are the data automatically shaped and forwarded by the cascaded circuit.

6. 24-bit data format

R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0

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

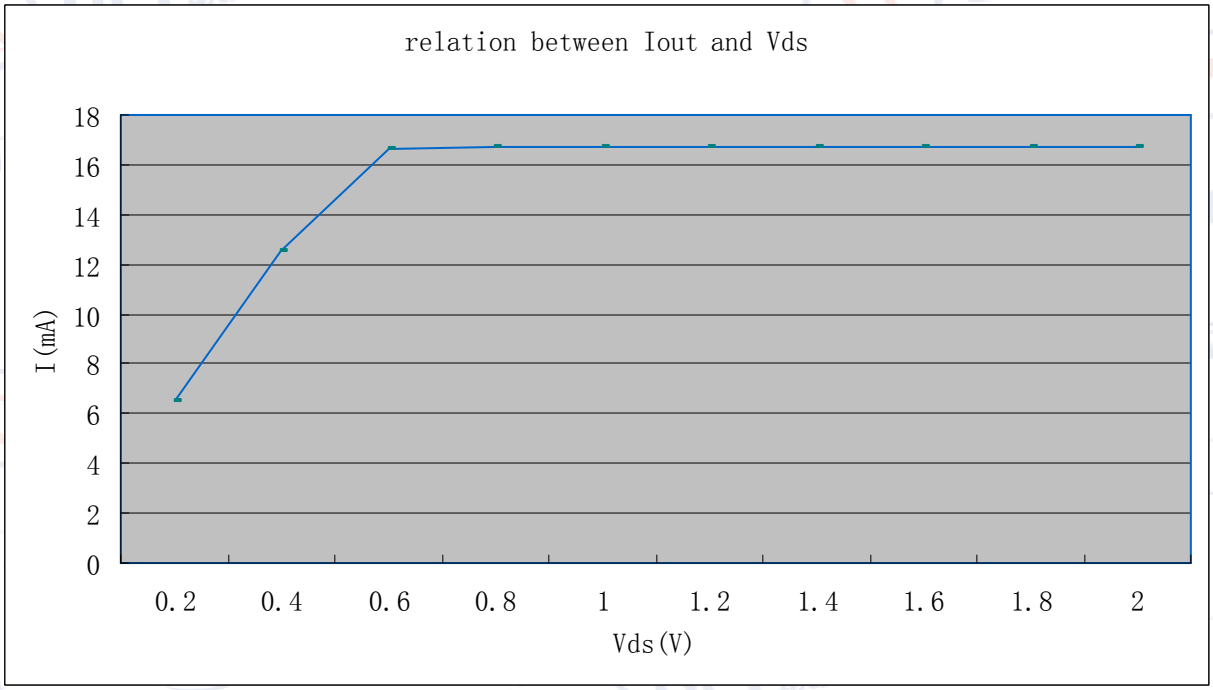
constant current characteristic

UCS1903N 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%

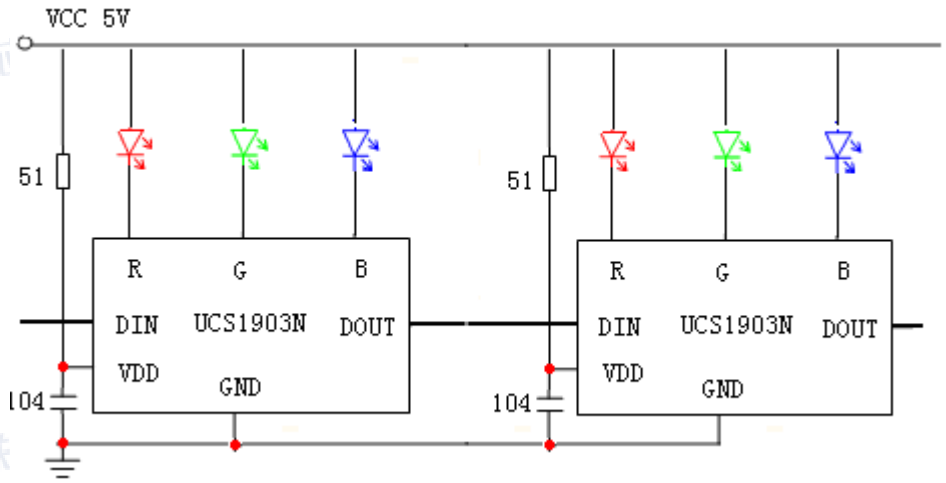
(2): When the voltage of the load change, UCS1903N output current is not affected, as shown in the figure below

(3): Below UCS1903N output port of the current I_{out} and add on the port voltage V_{ds} curve relationship。 the smaller the I_{out} current, the smaller in the condition of constant current need of V_{ds}.



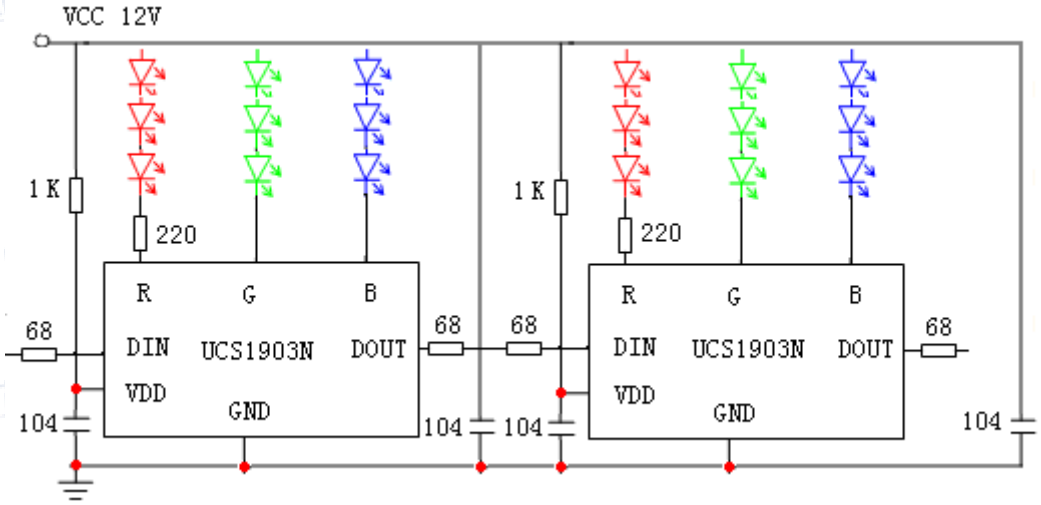
Typical Application circuit diagram

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.

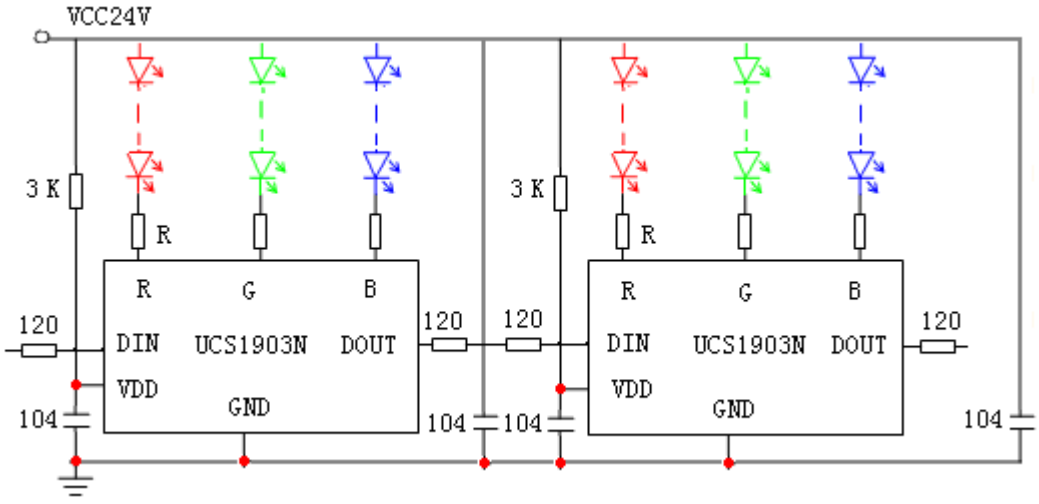
2. Power voltage is 12V



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

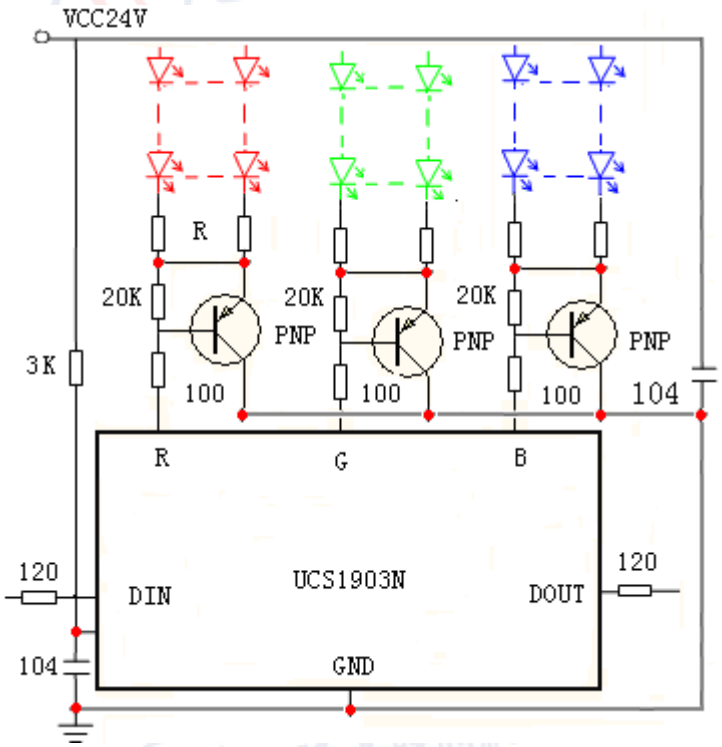
3 . Power voltage is 24V



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 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

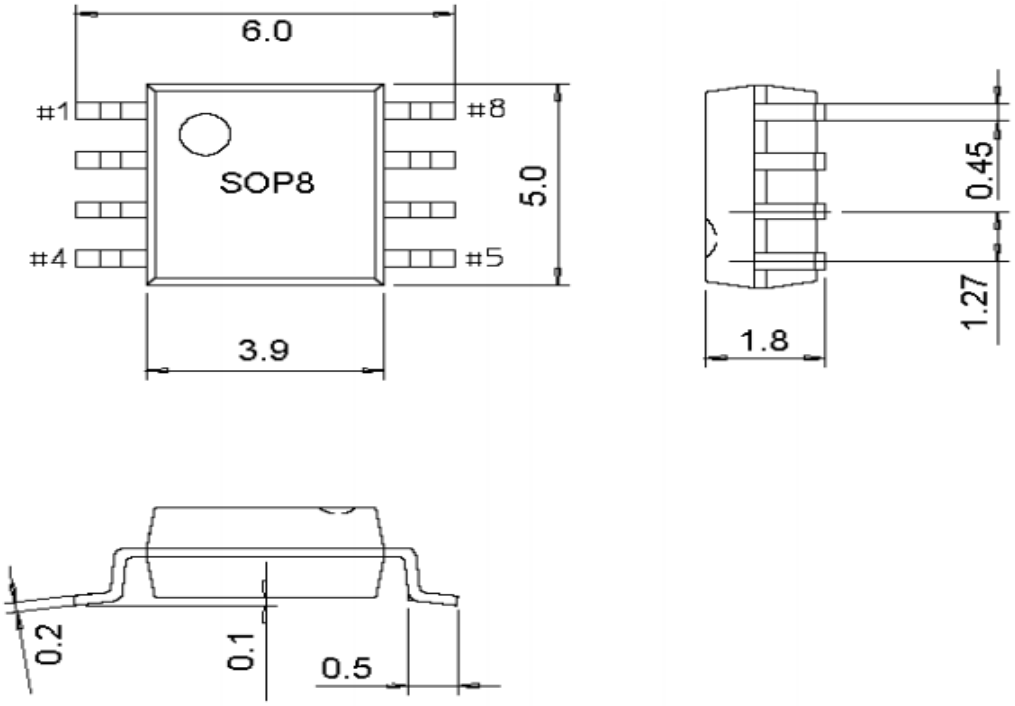
stabilizing voltage characteristic

UCS1903N 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

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