DMX512 8 bit high grayscale differential drive IC UCS512C3

Functional description:

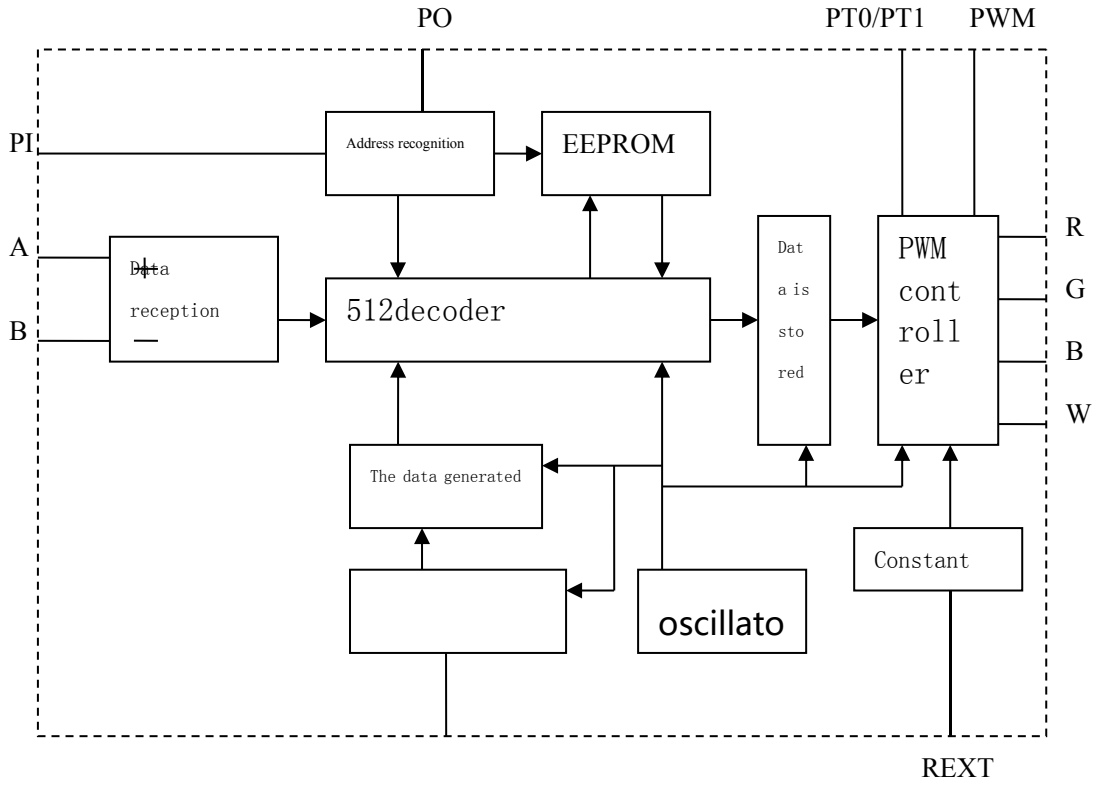
UCS512C3 is LED Drive chip Of Differential parallel protocol, 256 gray level, Can choose 1/2/3/4 channel High precision constant flow output。DMX512 signal can Accurate decoding by UCS512C3, and Compatibility and extension DMX512 signal。UCS512C3 can Received 200k-750k DMX512 signal, Address data Can be up to 4096 channel。UCS512C3 have E2PROM , and support Online writing Address。UCS512C3 have 4 channel R G B W, High precision constant current, each channel Can be up to 80mA, The refresh rate 3.6KHz。UCS512C3 have PWM reverse polarity frequency reduction output function, can plugin audion , MOS or Large current constant current drive IC。

Features:

- cover and extension DMX512(1990) Signaling protocol
- control mode: Difference in parallel, Maximum support of 4096 channels
- Received 200k-750k DMX512 signal
- Built-in 485 module, Differential signal has high resolution, Large differential input impedance, Greatly enhanced load
- Use AB line to write code, The maximum write distance is limited only by AB line
- Independent parameter writing function, can write parameters separately without having to rewrite the code
- RGBW output port grayscale: 8 bite
- Port refresh frequency is up to 3.6K
- Built-in 5V regulator tube, Output port withstand 30V
- Stable operation under 2.6v voltage, Improve stability of 5V power supply system
- R/G/B/W Four current output channel
- External output constant current adjustable resistance, Range of current per channel3~80mA
- Each IC have ±3% Current density difference
- PWM Choose the foot, can Select reverse polarity frequency reduction function, after Frequency reduction Port refresh rate 500HZ, suit for MOS or Large current constant current drive IC
- Industrial design, Stability of performance

Range of application :

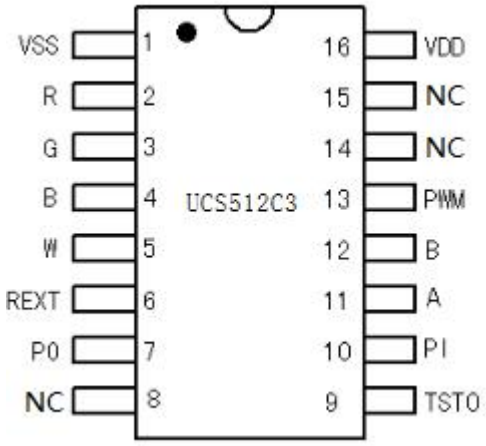
A point source, Line lights, Wash the wall lamp, Stage lighting system



Packaging form:

SOP16

Pin figure :



Pin description

	UCS512C3	
Serial number	symbol	Functional description
1	G N D	GROUND
2~5	RGBW	PWM output port , 256 gray
6	REXT	Constant current feedback end, adjust output current to ground resistance
7	PO	Address write code line output
8	NC	Empty feet
9	TST	Test foot, built-in drop-down
10	PI	Address write code line input,built-in pull-up
11	A	The differential signal, anode, built-in pull-up
12	B	The differential signal, cathode, built-in drop-down
13	PWM	Output polarity selection, general dangling, answer the VDD output polarity reversal, at the same time the port refresh frequency is reduced ti 250HZ
14	NC	Empty feet
15	NC	Empty feet
16	VDD	The power supply side, built-in 5V regulator tube

Maximum rating （unless otherwise specified，Ta＝ 25℃，Vdd＝ 5V）

parameter	symbol	range	unit
Logic supply voltage	Vdd	＋2.5～＋6.5	V
Output port withstand pressure	Vout	30	V
Logical input voltage	Vi	-0.5～Vdd＋0.5	V
Working temperature	Topt	-45～＋85	℃
Storage temperature	Tstg	-55～＋150	℃
Anti-static electricity capacity	ESD	8000	V
Output rating	Pd	800	mW

Recommended job scope （unless otherwise specified，Ta＝－40～＋85℃，Vdd＝5V）

Parameter	symbol	Minimum	Typical	Maximum	Unit	Test condition
Logic supply voltage	Vdd	2.6	5.5	6	V	-
High level input voltage	Vih	0.7Vdd	-	Vdd	V	-
Low input voltage	Vil	0	-	0.3Vdd	V	-
Output port pressure	Vout			30	V	

Electrical parameter （unless otherwise specified，Ta＝－40～＋85℃，Vss＝0V，Vdd＝4.5～5.5V）

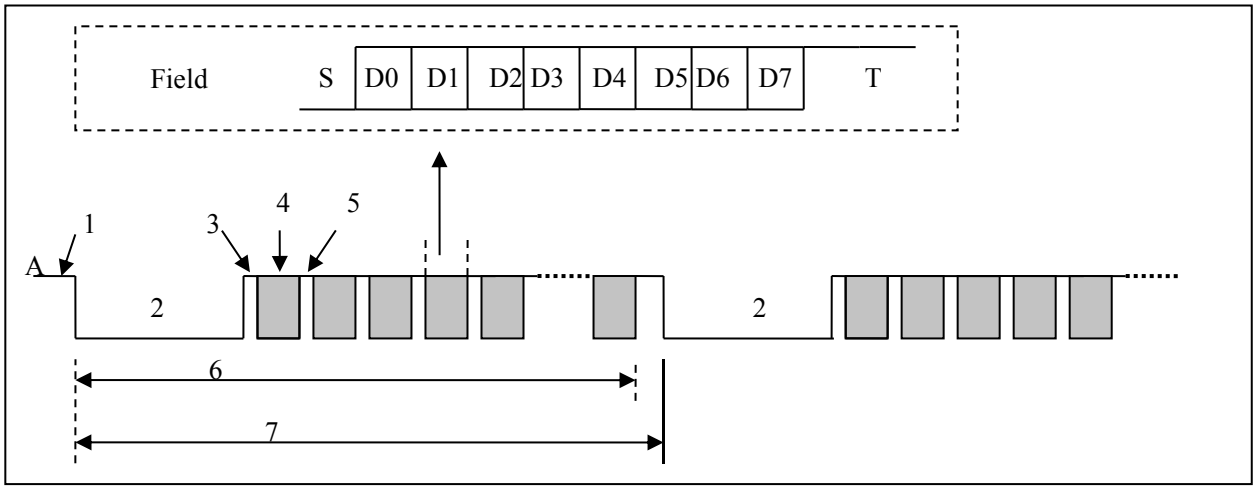
Electrical parameter	symbol	Minimum	Typical	Maximum	Unit	Test condition
Low level output current	Iol	10	-	-	mA	Vo ＝0.4V，PO
High level output current	Ioh	10	-	-	mA	Vo ＝4V，PO
Input current	Ii	-	-	±1	μA	
Differential input common mode voltage	Vcm			12	V	
Differential input current	Iab			28	uA	VDD=5V
Differential input threshold voltage	Vth	-0.2		0.2	V	0<Vcm<12V
Differential input hysteresis voltage			70		mV	Vcm=0V
Differential input impedance	Rin		280		KΩ	A,B to GND
Output pin current	Isink			80	mA	R，G，B，W
High level input voltage	Vih	0.7Vdd	-		V	PI
Low input voltage	Vil	-	-	0.3Vdd	V	PI
Current offset (Channel between)	dIout		±1.5	±3.0	%	Vds=1V，Iout=17mA
Current offset (Between the chip)	dIout		±3.0	±5.0	%	Vds=1V，Iout=17mA
Voltage Offset VS-Vds	%dVds		±0.1	±0.5	%/V	1V<Vds<3V
Voltage Offset VS-Vdd	%dVds		±1.0	±2.0	%/V	4.5V<Vdd<5.5V
Dynamic current loss	IDDdyn	Non-loaded		4	mA	VDD=5
Consumed power	PD			650	mW	（Ta=25℃）
Thermal resistance	Rth(j-a)	60		120	℃/W	

Switch features（unless otherwise specified，Ta＝－40～＋85℃，Vss＝0V，Vdd＝4.5～5.5V）

Electrical parameter	symbol	Minimum	Typical	Maximum	Unit	Test condition
Propagation delay time	Tflz	–	–	300	ns	Cl＝15pF，D_{IN} → D_{OUT}，Rl ＝10kΩ
Fall time	Tthz	–	–	120	μs	Cl＝300pF，OUTR/OUTG/OUTB
Data transfer rate	F			500	Kbps	
Input capacitance	Ci	–	–	15	pF	–

Communication data protocol：

UCS512C3 data conform to the standard dmx512(1990) protocol and extend DMX512 protocol，can received 250kbps to750K data。The energy protocol waveform is as follows：UCS512CN is 是 AB differential signal，picture is the timing waveform of A，B is the opposite of A。



Mark number	describe	Minimum	Typical	Maximum	Unit
	K bits per second	200	250	500	Kbps
	Bit data time	5	4	2	us
S	Start bit	5	4	2	us
D0~D7	Bit data time	5	4	2	us
T	2 stop bit	10	8	4	us
1	Pre-reset mark	0		1000000	us
2	Reset signal	88		1000000	us
3	Post-reset mark	8		1000000	us
4	Field（note1）	55	44	22	us
5	Spacing between field	0		1000000	us
6	Packet length	1024		1000000	us
7	Reset interval	4096		1000000	us

bit is the low level，the stop bit is the high level，the data in the data bit is 0，then the corresponding time period is low level;is 1，then the corresponding time period is high level。 0 starting bit，stop bits and data bit must have same time.

IC reception signal description：

1. When reset signal appears on AB line，IC goes into reception readiness。Address counter clear 0
2. First bite of the data package is 0 start bite，its 8-bit data must be“0000_0000”，the bits cannot be data display or other。From second bits is data display，second bits of 512 data package is first effective bits。IC can receive data transmission frequency from 200k to 750k。Different frequencies correspond bits time is different，data transmission frequency from 200k to 750k，make sure that data display is same like 0 start bite。
3. IC according to the address in E2 acquire corresponding data of 512 data packet。For example chip address is 0000_0000_0000, so IC acquire first valid data from data packet， address is 0000_0000_0001,IC acquire second valid data from data packet。

Announcements of Write the code：

1 make sure A（D+）,B（D-），GND connect right place of write code editor。
2. Before write code make sure the lamp R,G,B jump routine is normal，so can know AB line is there a problem. If the color wrong , do not write the code, first check line’s problem then write the code
3. After write the code,if the light received the code, R,G,B,W can open the brightness of the 22%,new code take effect。
4. Finish write the code,use the write code editor test code of light is right ,from the one light to the end one by one.

Notes for differential bus connection：

1. controller and IC,IC and IC must common ground，prevent breakdown IC by common-mode voltage。

2. A line and B line connect IC must use the same protective resistance ，make sure AB line side by side wiring.

3. AB line generally adopts twisted ， and or so use sheath line，but make sure use copper wire。High voltage and low voltage in same trunking or near launch tower or areas with ore lightning，use shielded twisted pair 。

4. 485 nodes in 485 bus must show by the trunk，general advice 485 bus use hand by hand’s bus topology。Star structure or tree structure have mainline plus branch,that can produce reflected signal，impact 485 communication quality。
5. 485 bus with the extension of transmission distance，can produce echoed signal，if 485 bus have long transmission,suggest merge into 120Ω resistance in 485 bus end

1.5S no signal state selection：IC can choose two state by controller ，one:IC keep last data,two:restore the power and light display。

Output constant current setting：

R，G，B，W is constant current output，the maximum constant current value can be reached 80mA，setting the current to a higher value is not recommended， avoid over the maximum power consumption。Constant current choose by REXT pin to GND resistance decade。The current formula：

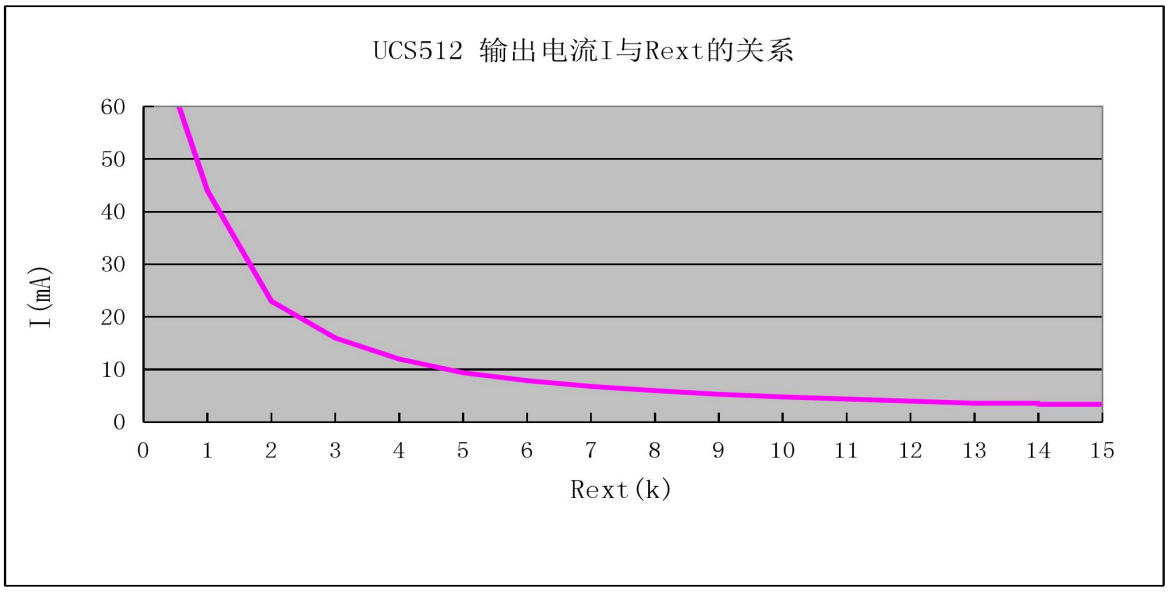
I=48/(400+Rext) （1）

Rext=(48/I)-400 (2)

Rext isREXT pin to GND resistance，I is R，G，B，W output port current。

For example：17mA of current，use（2）,Rext=（48/0.017）- 400，get Rext=2423Ω。

34mA of current，use（2），Rext=（48/0.034）- 400，get Rext=1011Ω。



Constant current curve：

UCS512C3 excellent constant current performance，the differences in current between channels and even between chips are minimal。

(1)：the current error between channels is less than ±3%，the current error between chips is less than ±5%。

(2)：when the load end voltage changes，the output current of UCS512CN is unaffected ，just like shown below

(3)：just like shown below the output current of UCS512C3 I and voltage applied to the port Vds curve relation can be known，I the smaller the current，the VDS required at constant current is also smaller。

Partial voltage resistance calculation：

VCC—N*Vled-min—VR < Vds-max

VR=I*R R is the partial pressure resistance

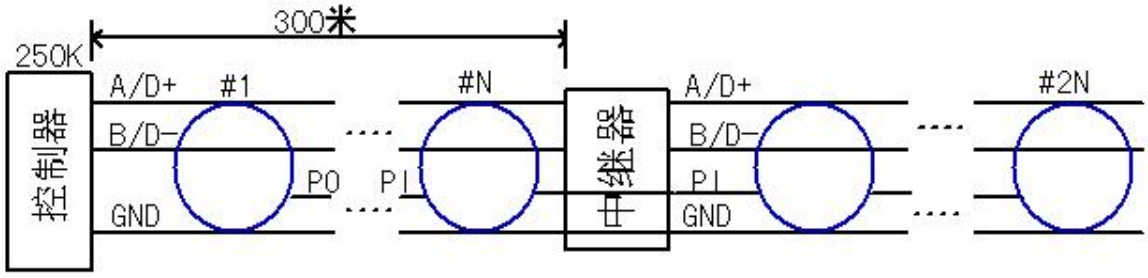
R > （VCC—-N*Vled-min—Vds-max)/I

VCC is the power supply voltage ， Vled-min is the minimum value of the lamps partial pressure resistance，N is number of lamp beads in series，Vds-max is maximum voltage per output pin，I is constant current value set。

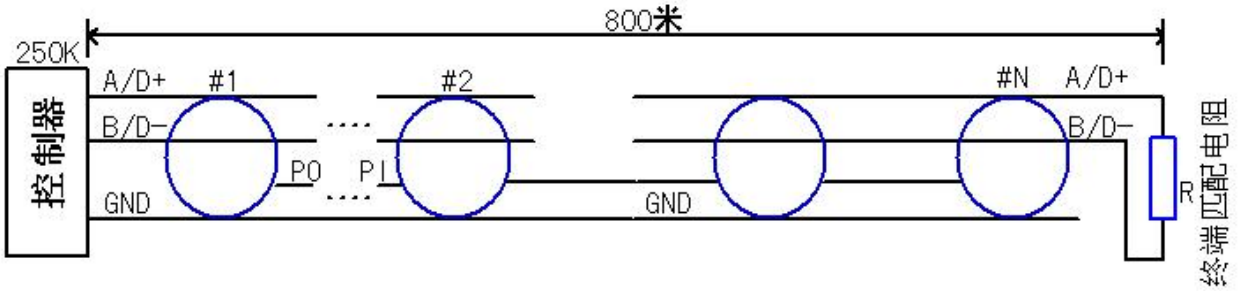
note：the power consumption should be considered when choosing the divider resistor

Schematic diagram of engineering connection

1. 250K standard DMX512 send the frequency

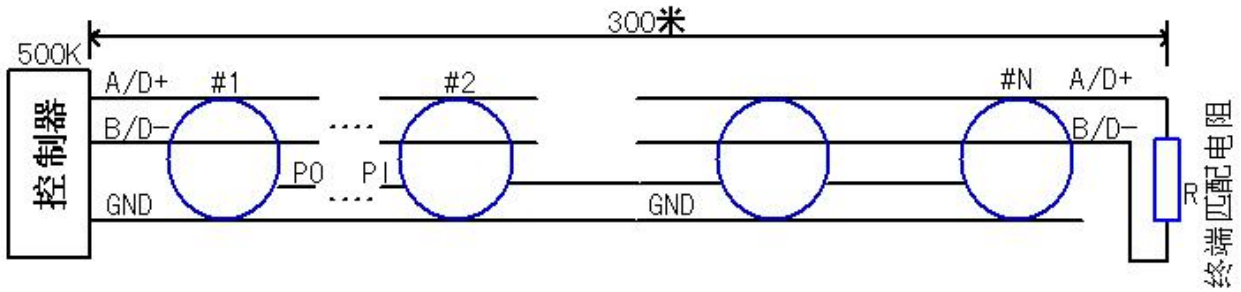


2. When the controller send the frequency is 250k，connect AB BUS up to 300 meters in no repeater and terminal matching resistance，up to 1024 loads can be hung in the line（N=1024），can use plain sheathed thread or ribbon cable，use twisted-pair cable can improve anti-interference ability。Suggest use class 5 or super class 5 cable in more interference，strong interference or much thunder and lightning area use shielded twisted pair。



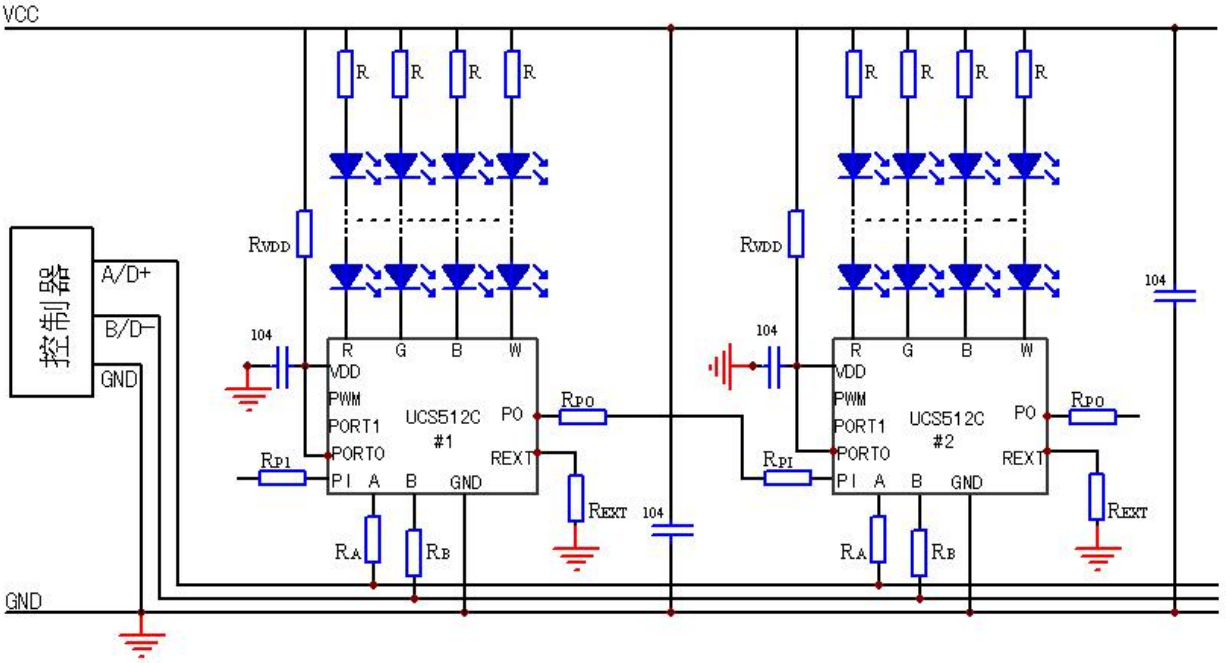
When the controller send the frequency is 250k， connect AB BUS up to 600 meters add terminal matching resistance in no repeater，up to 1024 loads can be hung in the line（N=1024），can use plain sheathed thread or ribbon cable，use twisted-pair cable can improve anti-interference ability。Suggest use class 5 or super class 5 cable in more interference，strong interference or much thunder and lightning area use shielded twisted pair。

3. 500K DMX512send the frequency



When the controller send the frequency is 500k， connect AB BUS up to 300 meters add terminal matching resistance in no repeater，up to 1024 loads can be hung in the line（N=1024），can use plain sheathed thread or ribbon cable，use twisted-pair cable can improve anti-interference ability。Suggest use class 5 or super class 5 cable in more interference，strong interference or much thunder and lightning area use shielded twisted pair。

Application of figure 1：RGBW，4 color application

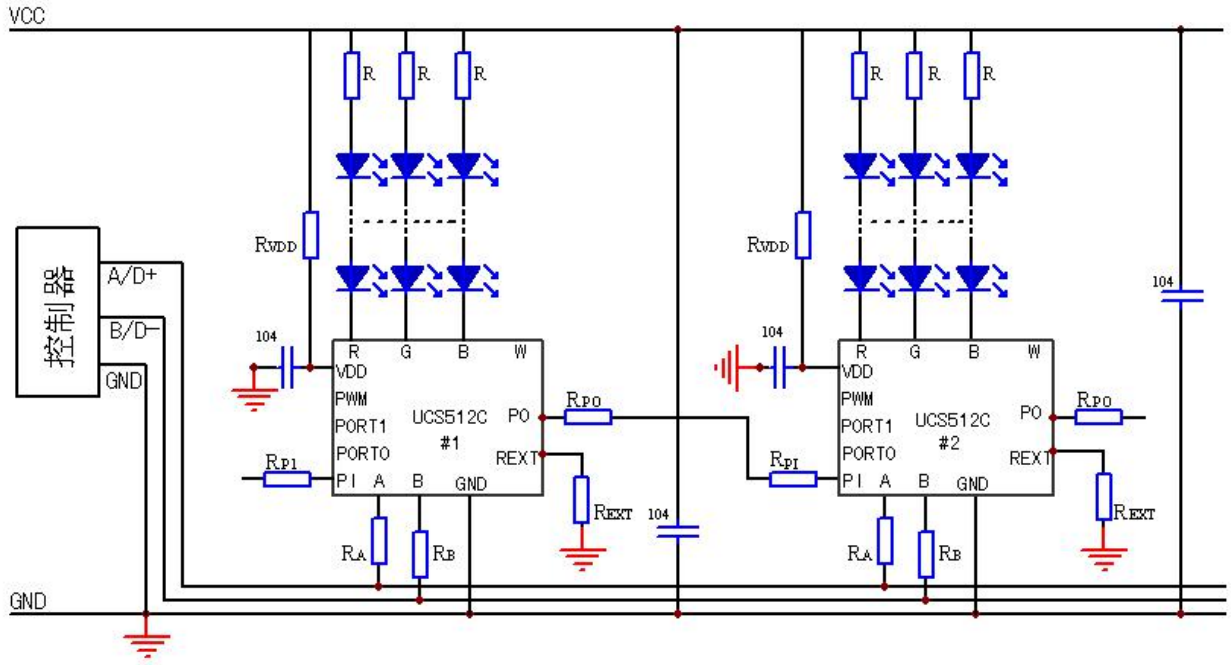


Note ：1. AB line writing mode is adopted，when writing code，write code editor/controller with first PI of IC not connect

2. pay attention to the choice of divider resistor ， avoid IC power consumption。

3. REXT port must add resistance to the ground set output current

Application of figure 2：RGB 3 color application

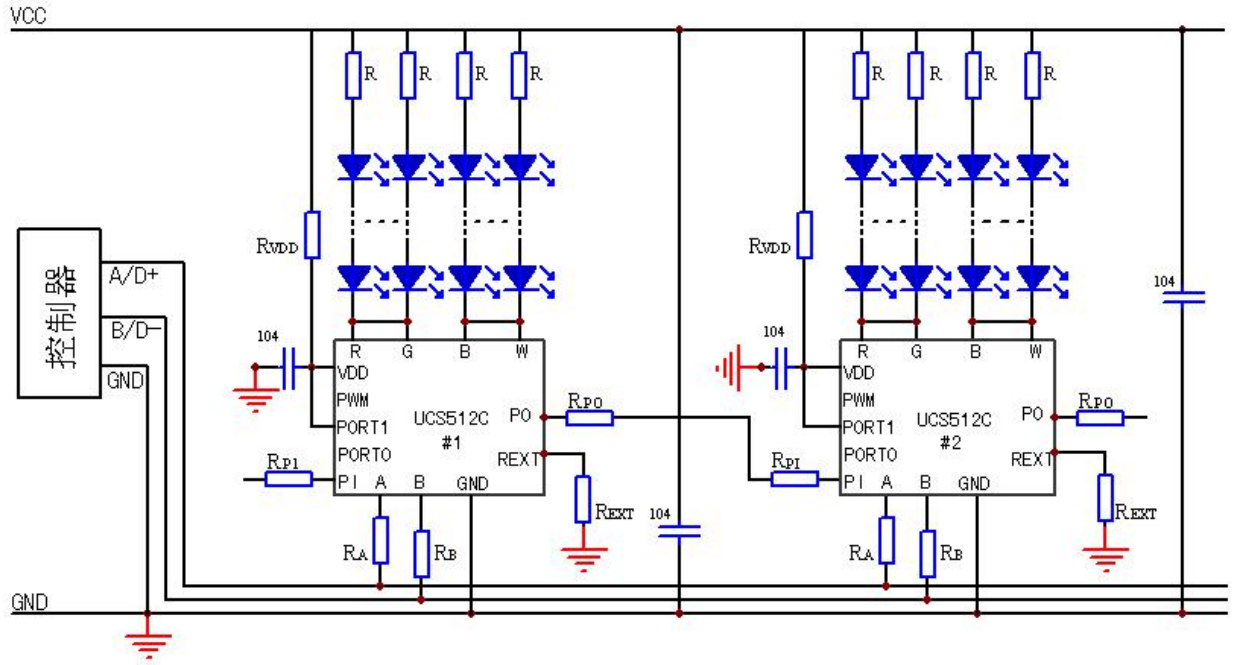


Note ：1. AB line writing mode is adopted，when writing code，write code editor/controller with first PI of IC not connect

2. pay attention to the choice of divider resistor ， avoid IC power consumption。

3. REXT port must add resistance to the ground set output current

Application of figure 3：2 color application

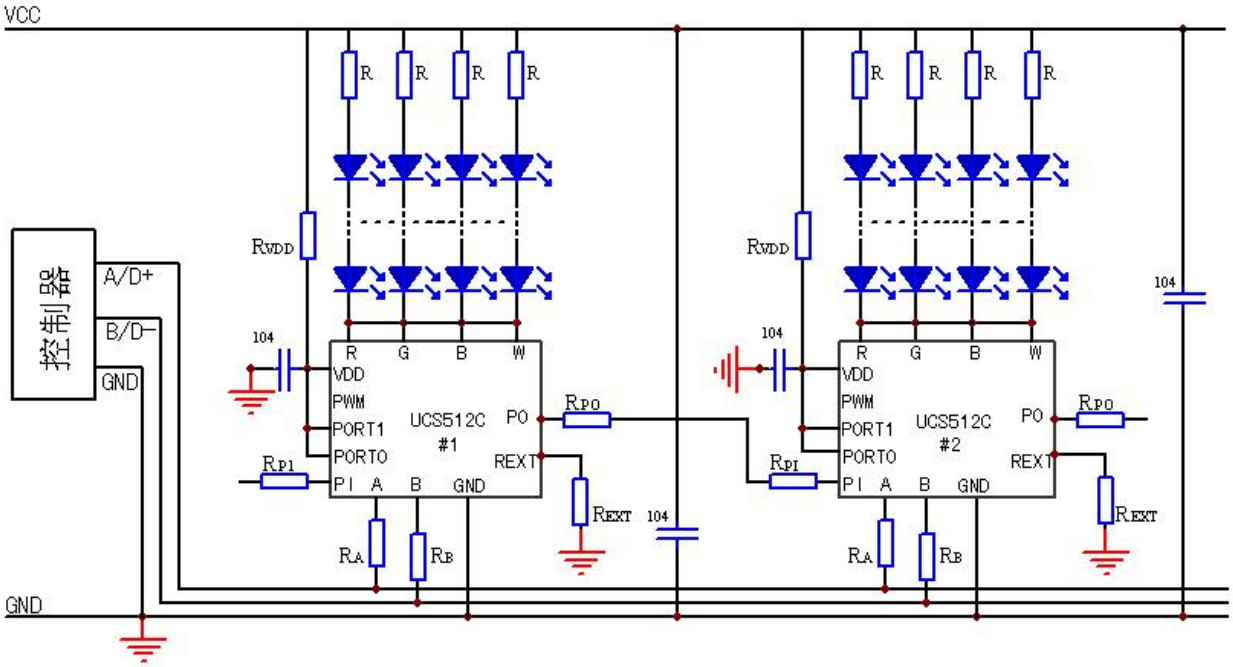


note：1.2 color application, the RG（BW） channel corresponds to the same channel data，they output is same，the figure shows the parallel diffuser application，the maximum output current of 2 channels in parallel is 160 mA

2. pay attention to the choice of divider resistor ，avoid IC power consumption。

3. REXT port must add resistance to the ground set output current

Application of figure 4：monochrome application

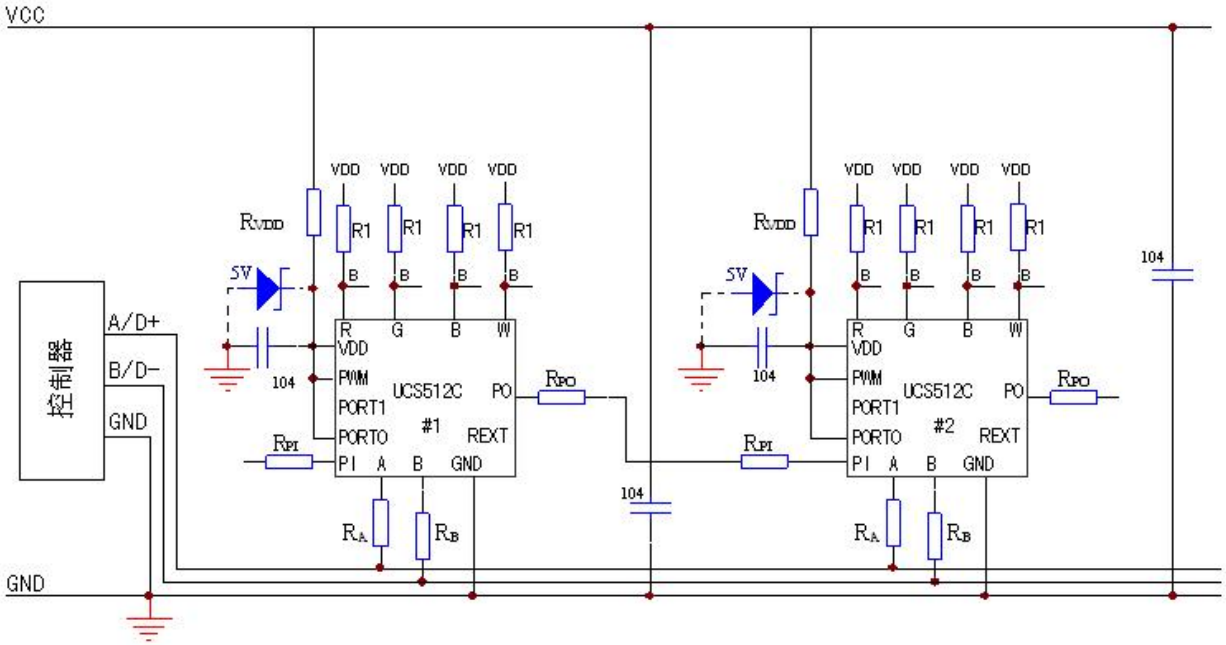


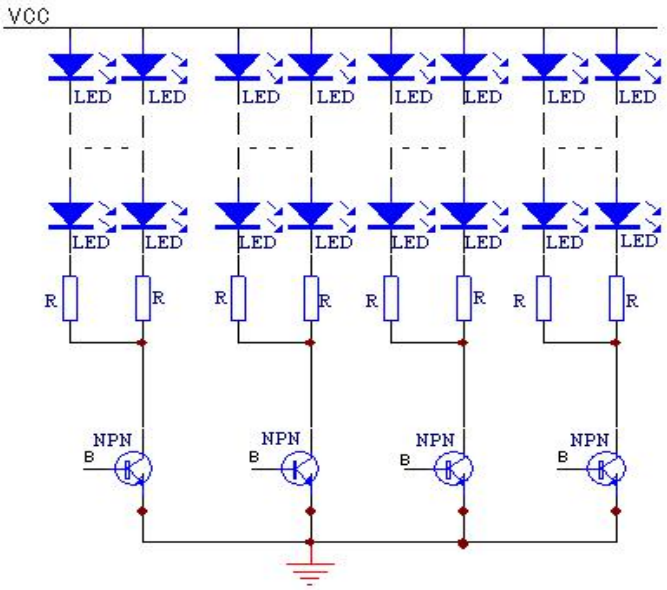
note：1. monochrome application，RGBW 4 channels correspond to the same address data，the output is same，

the figure shows the parallel diffuser application，the maximum output current is 320 mA after 4 channels are connected in parallel

2. pay attention to the choice of divider resistor ，avoid IC power consumption。
3. REXT port must add resistance to the ground set output current

Application of figure 5: external triode application





note： 1. PWM pin connect VDD，IC is the reverse polarity frequency drop constant voltage output，suitable for external NPN transistor base（B）。The output pin is connected with resistance R1 to VDD as shown in figure， the pull resistance R1 should be selected according to the triode amplification times and the required current。When the output current is large， the pull-up resistance needs

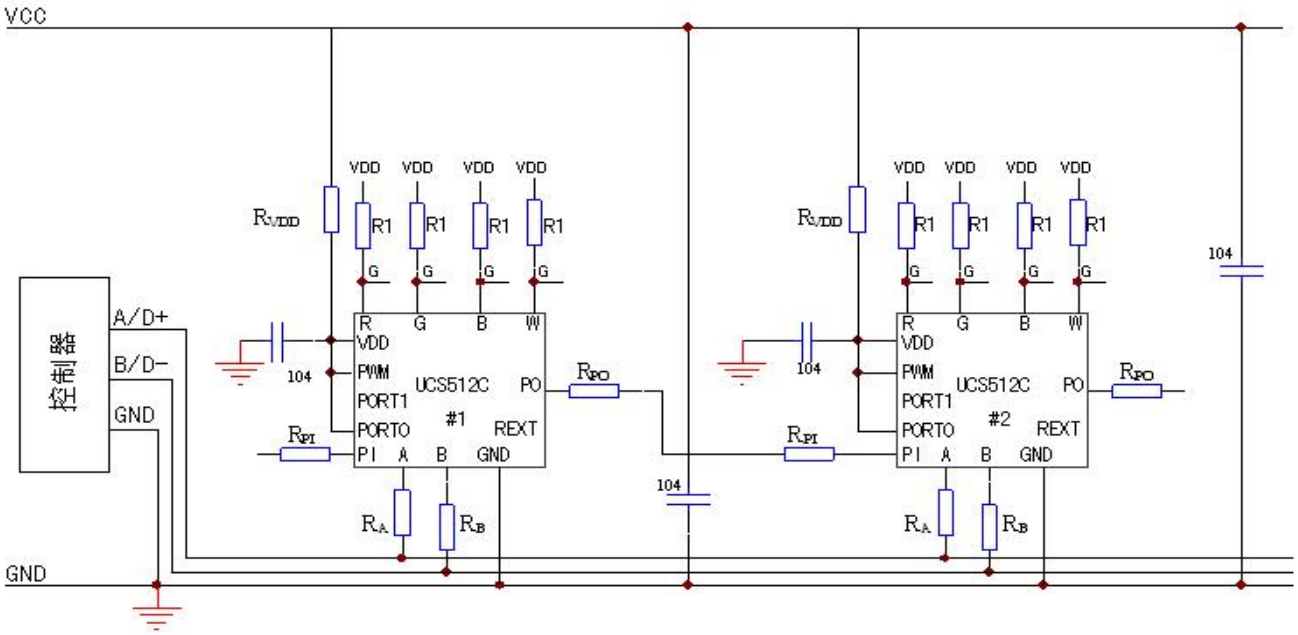
To be less than 5k（the base current is greater than 1mA)，reduce the value of step-down resistance and connect5V regulator or other 5V regulator on VDD。See component value table b for details:

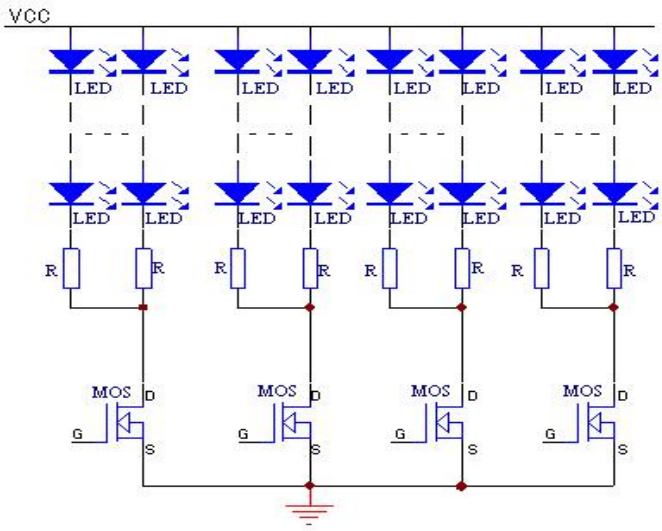
（external triode application）

2. the figure above shows the application diagram of 4 channel reverse polarity application。

3. in reverse polarity applications，the REXT port can be suspended

Application of figure 6：External mos tube applications





note： 1. PWM pin connect VDD is the reverse polarity frequency drop constant voltage output, suitable for external MOS tube gate (G)。When applied , the output pin is connected with

resistance R1 to VDD as shown in figure，the pull-up resistance is more than 10k，if you want to lower the first level of grayscale brightness，you can increase the resistance R1。

2. the figure above shows the application diagram of 4 channel reverse polarity application

4. in reverse polarity applications，the REXT port can be suspended

5. high-speed low-voltage MOS tube is available， for example:AP2306AGN。

Selected value of components A:（non triode applications）

element	24V	12V	5V
R_{VDD}	2K	750	82
R_{PI}	500	500	500
R_{PO}	500	500	500
R_A	5K	5K	5K
R_B	5K	5K	5K

note：attention should be paid to R_A/R_B package power ，in case RA/RB overpower burns out when AB line is wrongly connected to 24 V

Selected value of components B:（triode application，single current does not exceed 20mA）

element	DC24V	DC12V
R1（RGBW port pull resistor）	2.5K	2.5K
R_{VDD}	1K	300
Whether VDD is a voltage regulator	need	need

DMX512 and extend the agreement on the use of lamps

	Send frequency	Number of bus channels	Frame frequency
Standard protocol	250K	512	44
Channel development	250K	1024	22
Channel development	250K	1536	15
Send frequency and channel expansion	500K	1024	44
Send frequency and channel expansion	500K	1536	30
Send frequency and channel expansion	500K	2048	22

Package outline drawing and dimensions

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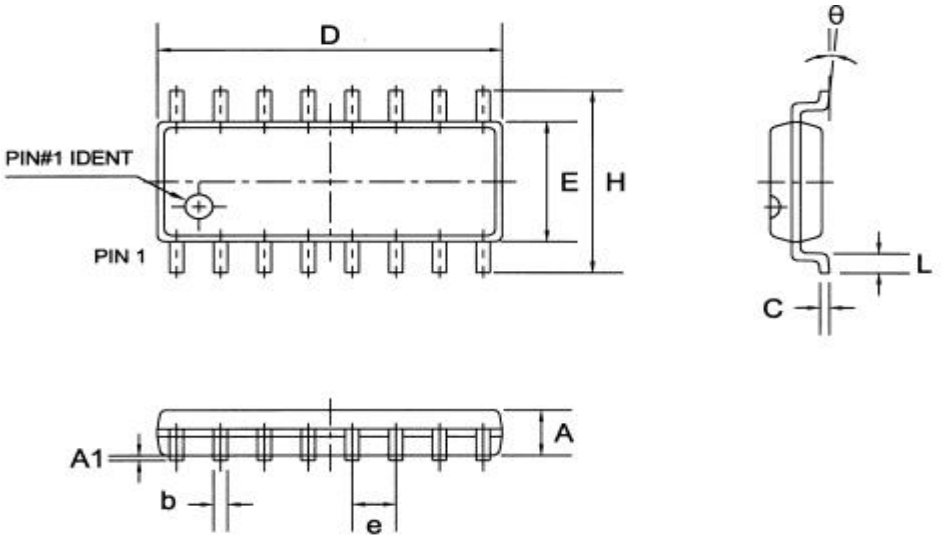

Symbol	Dimensions In Millmeters			Dimensions In Inches		
	Min	Nom	Max	Min	Nom	Max
A	1.30	1.50	1.70	0.051	0.059	0.067
A1	0.06	0.16	0.26	0.002	0.006	0.010
b	0.30	0.40	0.55	0.012	0.016	0.022
C	0.15	0.25	0.35	0.006	0.010	0.014
D	9.70	10.00	10.30	0.382	0.394	0.406
E	3.75	3.95	4.15	0.148	0.156	0.163
e	——	1.27	——	——	0.050	——
H	5.70	6.00	6.30	0.224	0.236	0.248
L	0.45	0.65	0.85	0.018	0.026	0.033
θ	0°	——	8°	0°	——	8°

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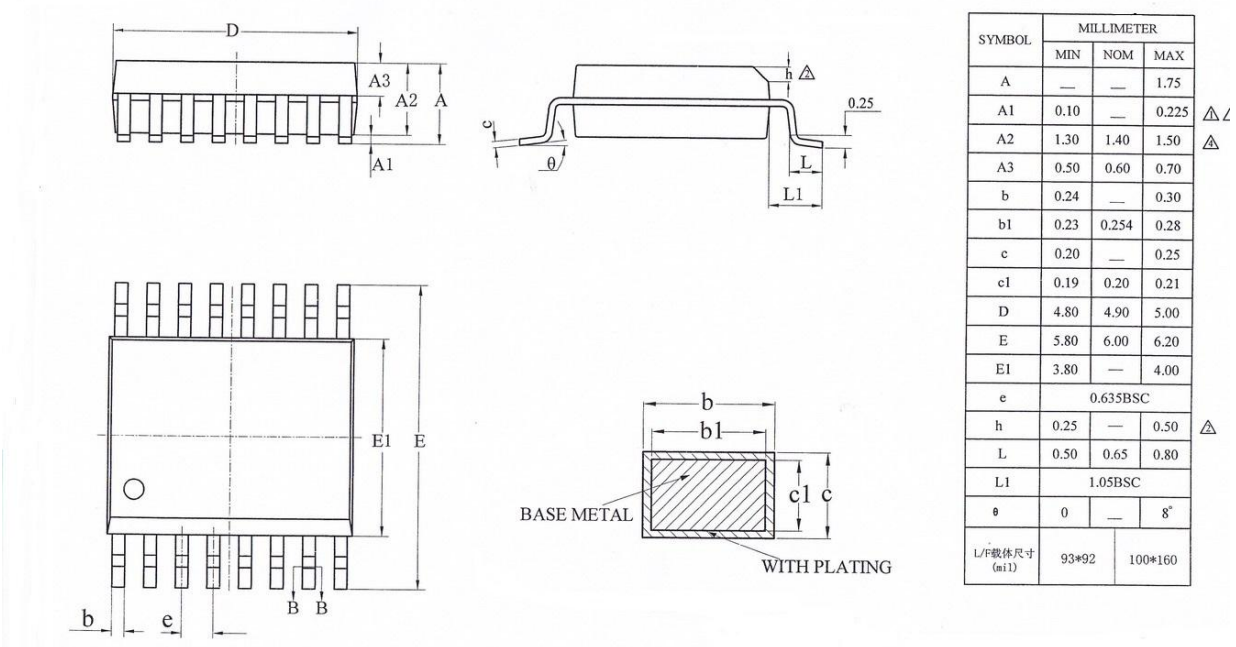

SYMBOL	MILLIMETER			
	MIN	NOM	MAX	
A	—	—	1.75	
A1	0.10	—	0.225	⚠7
A2	1.30	1.40	1.50	⚠4
A3	0.50	0.60	0.70	
b	0.24	—	0.30	
b1	0.23	0.254	0.28	
c	0.20	—	0.25	
c1	0.19	0.20	0.21	
D	4.80	4.90	5.00	
E	5.80	6.00	6.20	
E1	3.80	—	4.00	
e	0.635BSC			
h	0.25	—	0.50	⚠5
L	0.50	0.65	0.80	
L1	1.05BSC			
θ	0	—	8°	
L/F载体尺寸 (mil)	93*92		100*160	