

Hi512D parallel differential DMX512 driver

1. Features

- 5 channel PWM output, W/A Support current doubling mode
- Configurable frequency : 250/4K/8K/16K
- Configurable gamma: 1.0/2.0/2.2/2.5
- Power-on self-detection, used for manufacturing test
- Configurable default color when no signal
- 17~350mA for each channel
- Output port withstand voltage 36V
- Built-in RS485
- Built-in EEPROM, three backup, 4096 addresses
- Patented anti-interference technology
- Built-in 5Vregulator, VIN 5-36V
- Program parameter by light or as a whole mode
- Switch the default display effect or maintain the last frame display state
- Suit for MOS or Large current constant current drive IC
- Wide range baud-rate adaption: 0.2-2Mbps
- Industrial wide temperature design
- Built-in OTP

2. Application

- Exterior lighting of building/ scene lighting
- Landscape lighting
- Wash-wall lights
- Flood lights

4. Device summary

Part No.	PWM Mode	channel	Package	MPQ
Hi512D4	17mA~125mA	4	SOP16	4000
Hi512D4H	17mA~300mA	4	ESOP16	4000

3. Introduction

Hi512D is a 4-5 channel, parallel differential DMX512 decode LED driver, with wide range baud rate adaption for 0.2-2Mbps.

The built-in RS485 can support very long distance transmission, and the built-in EEPROM can support up to 4096 addresses, and no need to power on after programming. There are three backup and can automatically correct the errors as soon as power on.

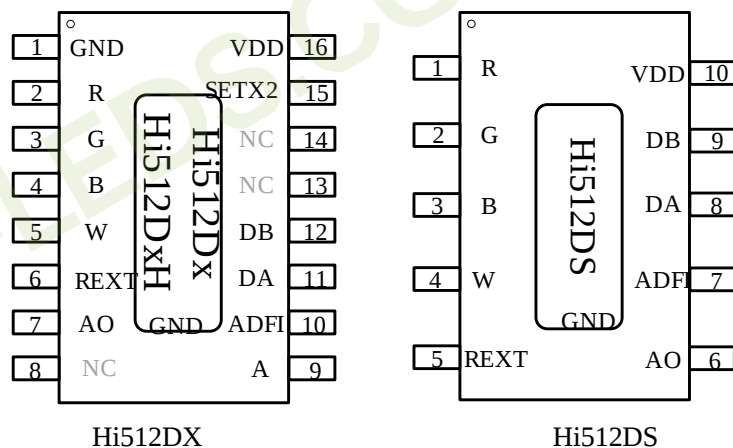
The PWM output is optimized for EMI test about 50%. It also increases anti-interference ability and fast response ability, especially for high power and fast switching products.

The chip support many kinds or configurable parameters, including: PWM switching frequency, power on color, self-detection, no signal effect, gamma, channel number, etc.

The patented gamma calculation and enhancement of low gray level display effect technologies can significantly avoid the gray loss, and make sure the gray level up to 65536 while the output frequency up to 16KHz without the current trimming, which may change the color temperature.

Hi512D5	17mA~125mA	5	SOP16	4000
Hi512D5H	17mA~300mA	5	ESOP16	4000
Hi512DS	17~200mA	4	ESSOP10	4000

5. Pin definition

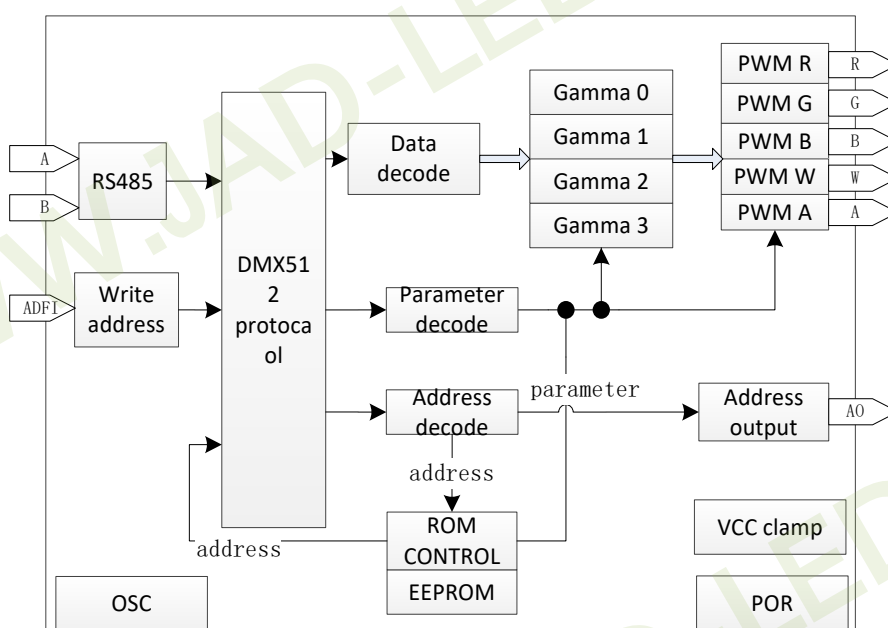


PIN NAME	Hi512DX Pin No.	Hi512DS Pin No.	Description
GND	1	1	Ground
R	2	2	PWM output red
G	3	3	PWM output green
B	4	4	PWM output blue
W	5	5	PWM output white
A	6		PWM output expansion 1
REXT	7		Output constant current set
NC	8/13/14	-	--
AO	7	6	Address writing output
ADFI	10	7	Address writing input
DA	11	8	Differential input data+
DB	12	9	Differential input data-
VDD	16	10	Power supply

6. Absolute maximum parameter

Symbol	description	Range	Unit
V_{CC}	Chip operating voltage	-0.4~6.3	V
V_{IN}	Logic input voltage	-0.4~ $V_{CC}+0.5$	V
V_{OUT}	Output withstand voltage	-0.4~ $V_{CC}+0.5$	V
T_a	Operating temperature	-40 - 85	°C
T_{stg}	Storage temperature	-40 - 150	°C
ESD	ESD(HBM)	>4K	V

7. Hierarchy



Graph 7.1 hierarchy

NOTE: Only the Hi512D5 support expansion channel 5, the Hi512D4(S) only support R G B W output.

8. Electrical operating parameter

(unless otherwise stated, VDD = 5V, T_A=25°C)

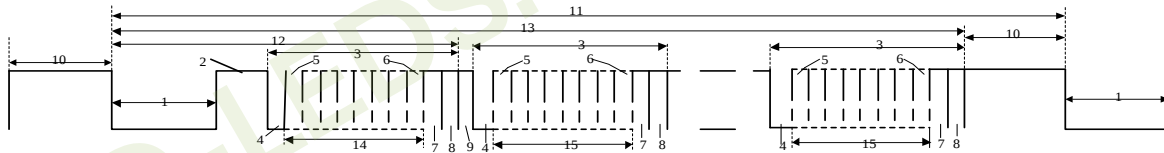
Symbol	Description	Test condition	Range			Unit
			MIN	TYP	MAX	
VCC	Clamp voltage	12V input, with 400Ω resistance	5.3		6.3	V
T _{osc}	Internal OSC period	VCC=5V	50		65	ns
R_ADFI	ADFI pull-up resistor	VCC=5V		16K		Ω
I _{AB}	Differential input port	VCC=5V		25		uA
VAB _{CM}	Differential input common-mode voltage	VCC=5V		5		V
VAB	Differential input voltage	VCC=5V	-0.4		5	V
V _{delay}	Input threshold voltage			200		mV
F _{LED}	PWM output frequency	VCC=5V	250		16K	Hz
I _{VCC}	Operating current			5		mA
Dout _H	Output pull up current	VCC=5V DOUT=0V		60		mA
Dout _L	Output pull down current	VCC=5V DOUT=5V		60		mA
RAB	Input pull down resistor			220		KΩ
I _{SINK}	Output pin current		17		350	mA
VDS	Output port pressure			36		V
VDS _I	input hysteresis voltage	IOU=80mA		0.7		V
T _{ovt}	Over temperature process			115		°C

9. Switching characteristic

Symbol	Description	Test condition	Range			Unit
			MIN	TYP	MAX	
T _{DELAY}	Data transmission delay	VCC=5.2V			300	ns
T _{ON}	PWM transfer time	VCC=5.2V			65	ns
T _{OFF}	PWM transfer time	VCC=5.2V			60	ns
C _{IN}	Input capacitor	VCC=5.2V		10		pF

10. Data protocol

The chip is completely compatible with DMX512(1990) protocol, the baud-rate can support 250K-1.6Mbps adaptable. A/B port support differential transmission. A is data+ while B is data- .



No.	Description	Min	Typ	Max	Unit
-	Bit Rate	-	250	-	kbit/s
-	Bit Time	3.92	4	4.08	us
-	Minimum Update Time for 513 slots	-	22.7	-	ms
-	Maximum Update Rate for 513 slots	-	44	-	/s
1	"SPACE" for BREAK	88	-	-	us
2	"MARK" After BREAK (MAB)	8	-	<1.00	s
3	Slot time	43.12	44	44.88	us
4	Start bit	3.92	4	4.08	us
5	LSB	3.92	4	4.08	us
6	MSB	3.92	4	4.08	us
7	STOP	3.92	4	4.08	us
8	STOP	3.92	4	4.08	us
9	"MARK" Time Between slots	0	-	<1.00	s
10	"MARK" Before BREAK (MBB)	0	-	<1.00	s
11	BREAK to BREAK Time	1196	-	1.00	s
13	DMX512 Packet	1196	-	1.00	s
14	START CODE (Slot 0 Data)	31.36	32	32.64	us
15	SLOT 1 DATA	31.36	32	32.64	us

Note:

Each data segment includes 11 bits, bit 0 is start code, bit1-9 are data, bit10-11are stop code.

The width of each bit should be equal to make sure the sample can be correct.

Start code is used for baud-rate detection, so its width must be equal to the last bit width.

11. System application

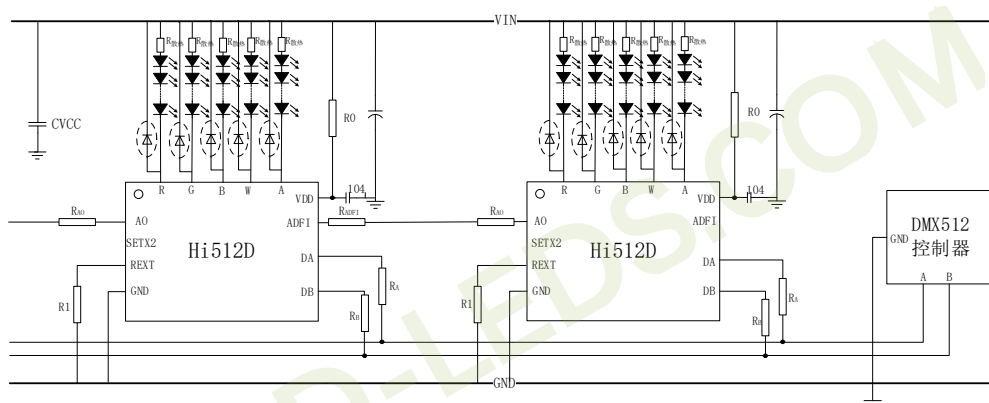
The chip can be used for 65536 gray level with PWM output 16KHz frequency. Its gamma can be configured as 1.0/2.0/2.2/2.5.

The patented gamma calculation and enhancement of low gray level display effect technologies can significantly avoid the gray loss. It can be compatible with normal DCDC or linear driver.

11.1. Typical application description

Hi512D is mainly designed for wash-wall lights, flood lights, stage lights, high power point lights. The output can make the external DCDC driver reach fast switching and anti-interference ability, comparing with the open-drain output. It also simplifies the PCB layout.

It is recommended to use Hichips' DCDC driver to avoid compatibility problems.



Graph 11.1.1 Applition graph

- It's recommended to use twisted pair transmission for A/B port.
- It's recommended to add 10uF capacitor to VIN&GND when used for high power application.
- RA RB are protect resistor for differential signals, 3K~10K is recommended.
- RADFI is the writing address input signal protect resistor, and 500~1000Ohm is recommended.
- RAO is writing address output, and 500~1000Ohm is recommended.
- R1 is REXT pin to GND resistance, I is R, G, B, W output port current.

11.2. VCC resistance

The working current is supplied mainly by R0. Normally, VCC should be:

$$VCC = VIN - I_D \times R_0$$

The table below is recommended:

VIN (V)	5	12	24
R0 (Ω)	20	0.5K	1.5K

11.3. Output constant current setting

R, G, B, W is constant current output, the maximum constant current value can be reached 350mA, 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:

$$I_{OUT}(mA) = 17 + \frac{545}{R_{EXT}(K\Omega)}$$

For example: 60mA of current, get Rext=1011Ω

11.4. Divider resistance

consumption calculation, to prevent IC over power consumption, Vds the maximum actual usage value is not recommended to exceed vds-max. The table below for 25°C environment temperature:

	30mA	60mA	80mA	100mA
Hi512D4	6V	3V	2.2V	1.8V
Hi512D5	5V	2.5V	1.8V	1.5V

	120mA	180mA	250mA	300mA
Hi512DS	2.2V	1.5V	-	-
Hi512D4H	3V	2V	1.4V	1.2V
Hi512D5H	2.2V	1.5V	1.2V	1.1V

Partial voltage resistance calculation:

$$VCC - N * V_{led-min} - VR < V_{ds-max}$$

$VR = I * R$ R is the partial pressure resistance

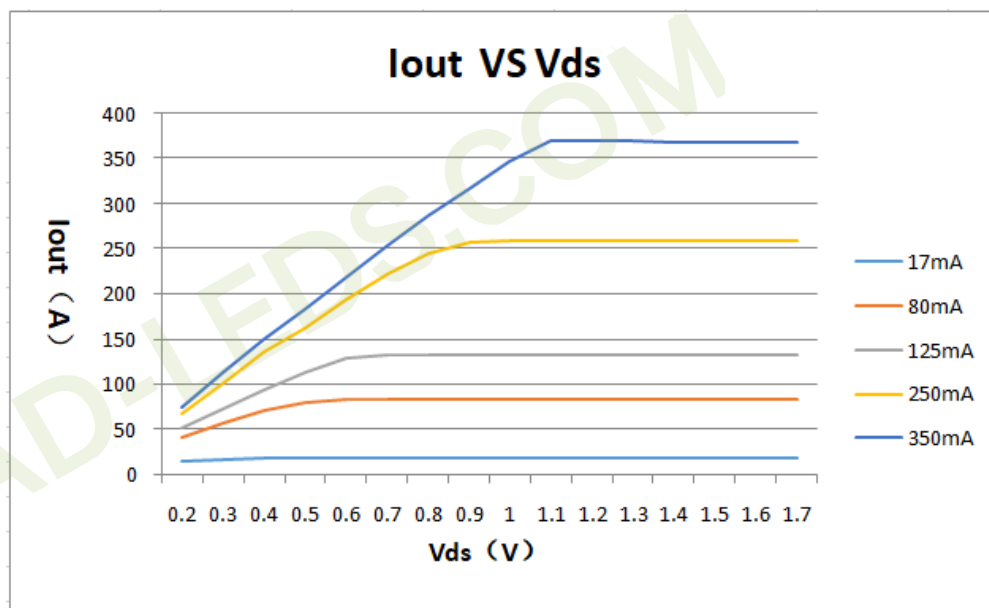
$$R > (VCC - N * V_{LED} - V_{DS}) / I$$

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.

11.5. Constant Current Characteristic

When it gets to constant current knee point, the output current is not affected by OUT voltage(V_{DS}). relationship between I_{OUT} and V_{DS} is shown below.



11.6. function description

After the instruction is successfully written, the first light will be red (25%), and the rest will be green (25%);

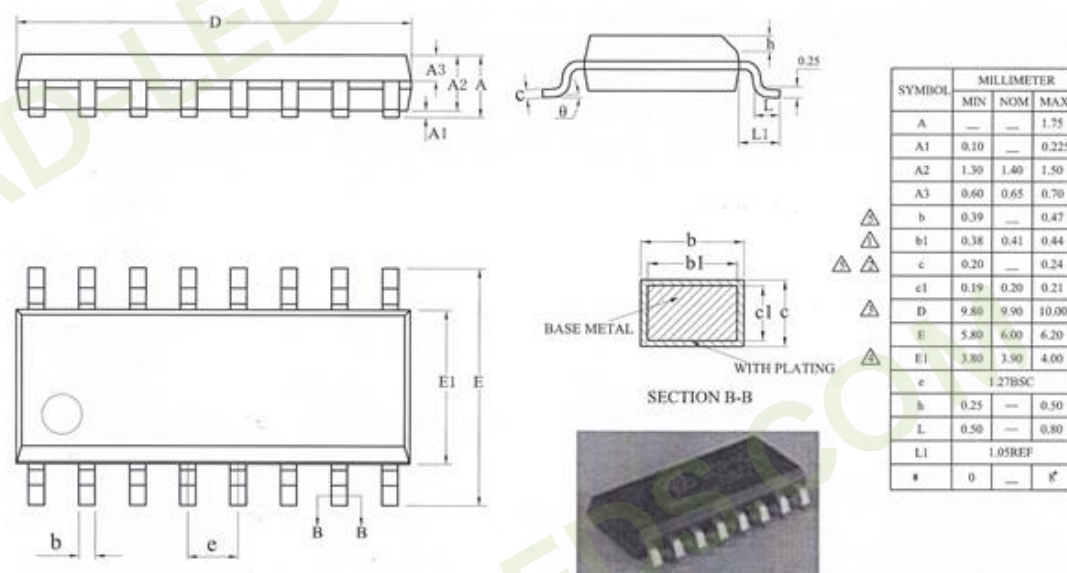
The chip built-in a variety of effects, can be set through the controller synchronous jump, gradient and flashing effects, in addition to support a variety of effects together with the rotation mode, convenient production sample and some simple application without controller. The chip can also support no signal default color matching, convenient for customers to achieve a variety of needs, such as can be in the case of no signal, through the use of the chip's lighting system to display a preset pattern.

Channel Configuration:

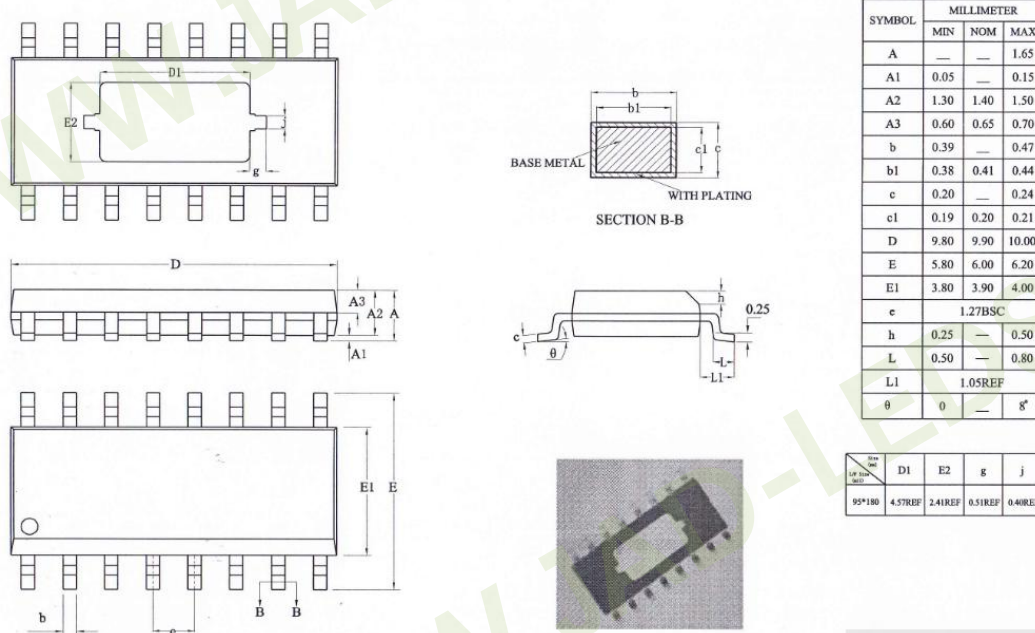
- The chip can be configured with current channels through the controller or decoder, and can be configured with 1/2/3/4/5 channels. Hi512D4/H supports 1/2/3/4 channel configuration:
 - intercepts the 1 field and matches the 1/2/3/4/5 field
 - intercepts 2 fields, matches 1/2 fields, and matches 3/4 fields
 - intercepts 3 fields, matches 1 field, matches 2 field, matches 3 field
 - intercepts 4 fields, matches 1 field, matches 2 field, matches 3 field, matches 4/5 field
- For 5-channel Hi512D5/H applications, when the controller sets the output signals of channels W and A to be the same, if the current of channels W is insufficient, you can connect channels A and W together to expand the current, making the system more flexible and convenient.

12. Package

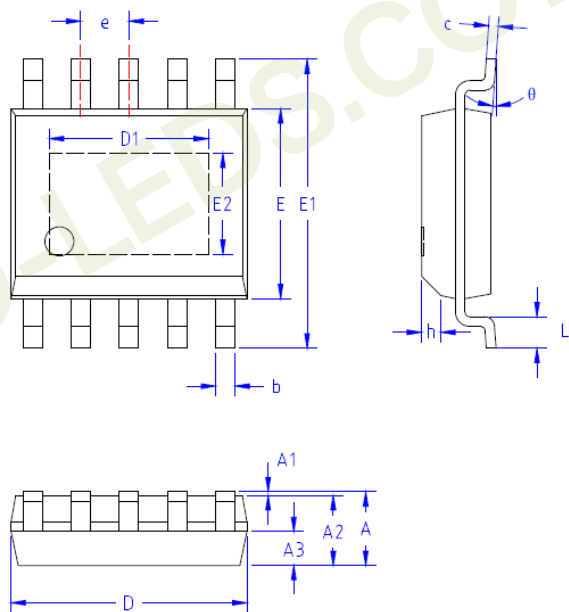
Hi512D4/5



Hi512D4H/5H



Hi512DS



机械尺寸/mm			
字符	最小值	典型值	最大值
A	1.500	1.600	1.700
A1	0.000	-	0.100
A2	1.350	1.450	1.550
A3	0.650	0.700	0.750
b	0.300	-	0.500
c	0.190	-	0.250
D	4.800	4.900	5.000
D1	3.200	3.300	3.400
E	3.840	3.940	4.040
E1	5.900	6.000	6.100
E2	2.000	2.100	2.200
e	1.00 (BSC)		
h	0.250	-	0.500
L	0.520	-	0.720
θ	0°	-	8°