

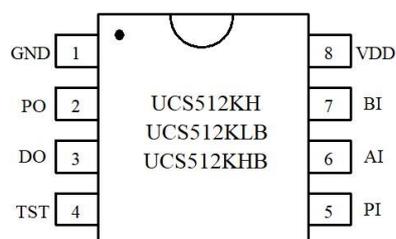
functional description :

The Lianxinke Intelligent Automatic Coding Series employs patented [multi-algorithm error recognition](#) technology in coding lines, ensuring stable and reliable full-time automatic coding. It supports 0-field functionality for first-board IC applications, enabling lamps to operate without coding after factory release. This simplifies engineering installation and after-sales maintenance. Different IC series within the Intelligent Automatic Coding Series can be mixed for automatic coding in lamps. The UCS512K series features a 512 differential parallel protocol decoding IC with decoding and forwarding capabilities, controlling our company's 9812,8903/8904,7604/7606/7612,7804/7904, and 19/29 series ICs through DO ports, capable of forwarding 128 video channel data. Equipped with high-quality million-standard E2PROM, the UCS512K series requires no external connection. Designed for building decoration and stage lighting effects, it is ideal for parallel-connected LED lighting systems. An abnormality in one chip does not affect other chips' normal operation, ensuring simple and convenient maintenance.

characteristic :

- Compatible with and supports the DMX512 (1990) signal protocol;
- Control mode: Differential parallel, supports up to 4096 channels
- The adaptive decoding technology with 12-bit precision enables accurate decoding of DMX512 signals transmitted at speeds ranging from 200K to 750kbps.
- Built-in Differential Signal Resolution 485 Module
- Built-in high-impedance interference-resistant E2 memory with million writes, delivering high-quality performance and long-term stable operation
- Industrial-grade design, stable and reliable
- Built-in 5V voltage regulator
- Simple forwarding mode: Supports 128 video channel data forwarding
- Three manual code writing methods: conventional cascaded code writing, self-channel cascaded code writing, and parallel code writing
- Two parameter writing methods: Cascaded parameter writing and Parallel parameter writing
- The UCS512K series supports multiple configurable parameter functions.
- Forwarded model: Our company's UCS9812/8903/8904/19/29 series/7904/7604/7606/7612/7614/7624/8612/8606
- Compatible with UCS512G series and UCS512H4 series, supporting both conventional manual cascaded writing and manual parallel writing.
- The automatic code-writing function is compatible with both the UCS512G series and UCS512H4 series. These series can be connected in series for mixed use of automatic code-writing, enabling the integration of point light sources, linear lights, and high-power lamps with automatic code-writing capabilities.
- Compatible with UCS512H0L first board mode: Enables full-process code-free operation for engineering installation and after-sales services
- Channel count: Set the number of channels required for each IC to control forwarding. This is necessary for automatic code writing and channel-level cascaded code writing.
- Segment forwarding count: Enables multi-segment lighting applications with fewer segments through parameter settings
- Channel forwarding count: This applies when multiple channels are required for parallel flow expansion, and can also be flexibly used when some channels of the forwarded IC remain unused.
- Channel forwarding sequence: Configures the wiring order of RGBW1W2W3W4 channels on a lamp, enabling compatibility between lamps with different wiring sequences.
- Segment color count: Defines the number of single segment colors for a light fixture, up to 7 colors
- Current setting: Adjust current level through parameter configuration
- Power-on lighting: Sets any grayscale combination for power-on lighting
- 1.5S no signal: Option to retain the last frame or restore power-on lighting

Package type and pin layout: SOP8



**Foot position instructions**

UCS512KH/KHB/KLB		
Order number	Symbol	Functional description
1	VSS	The earth
2	P0	Address code line output
3	D0	Channel for decoding and forwarding
4	TEST	Test foot
5	PI	Address code line input
6	AI	Positive differential signal
7	BI	Negative differential signal
8	VDD	Built-in 5V Zener diode at the power supply end

Maximum rated value(unless otherwise specified, $T_a = 25^\circ\text{C}$, $V_{dd} = 5\text{V}$)

Parameter	Symbol	Scope	Unit
Logic power supply voltage	V_{dd}	+ 2.5 ~ + 6.5	V
Logic input voltage	V_i	-0.5 ~ $V_{dd} + 0.5$	V
Working temperature	T_{opt}	-45 ~ + 85	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 ~ + 150	$^\circ\text{C}$
Antistatic	ESD	6000	V
Output rating	P_d	400	mW

Recommended operating range(unless otherwise specified, $T_a = -40 \sim +85^\circ\text{C}$, $V_{dd} = 5\text{V}$)

Parameter	Symbol	Minimum	Typical case	Maximum	Unit	Test condition
Logic power supply voltage	V_{dd}	3	5.2	6	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	-

Electrical parameters(unless otherwise specified, $T_a = -40 \sim +85^\circ\text{C}$, $V_{ss} = 0\text{V}$, $V_{dd} = 4.5 \sim 5.5\text{V}$)

Parameter	Symbol	Minimum	Typical case	Maximum	Unit	Test condition
Low level output current	I_{ol}		10	-	mA	$V_o = 0.4\text{V}$, DO, P0
High level output point current	I_{oh}		8	-	mA	$V_o = 4.6\text{V}$, DO, P0
Input currenton	I_i	-	190		μA	PI=5V
Differential input common-mode voltage	V_{cm}	7			V	

DMX512 Intelligent Automatic Code Writing Series: selectable number of segments, selectable number of channels, selectable color sequence, selectable number of colors, UCS512K Series

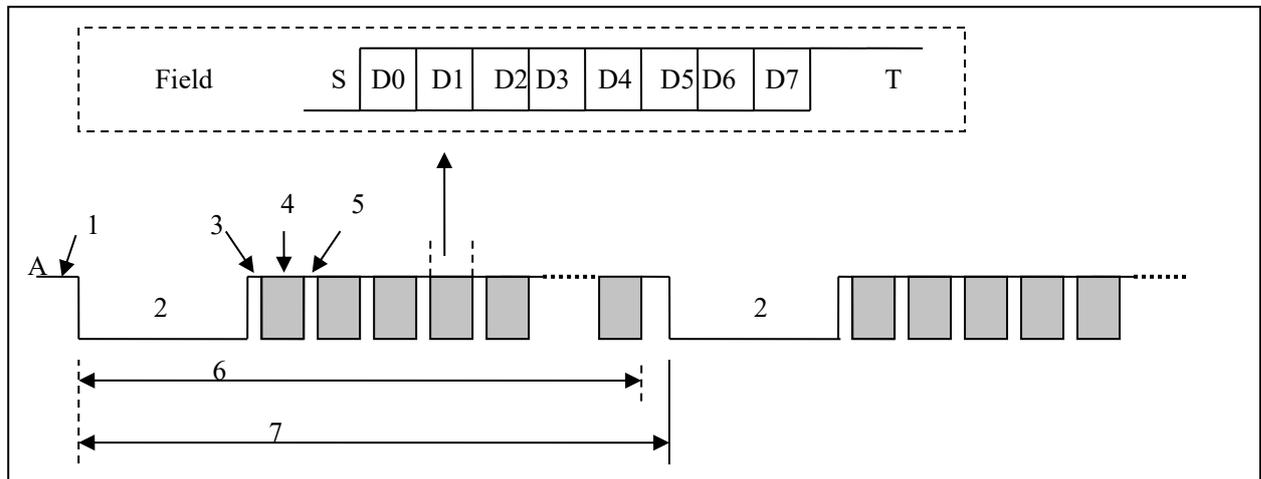
Differential input current	I_{ab}		30		μA	$V_{DD}=5V$
Differential input threshold voltage	V_{th}	-0.2		0.2	V	$0 < V_{cm} < 12V$
Differential input hysteresis voltage			70		mV	$V_{cm}=0V$
Differential input impedance	R_{in}		280		K Ω	A, B lines to the ground
High level input voltage	V_{ih}	$0.7V_{DD}$	-		V	PI
Low level input voltage	V_{il}	-	-	$0.3V_{DD}$	V	PI
Dynamic current loss	I_{DDdyn}		2.5		mA	$V_{DD}=5$
Consumed power	PD		400		mW	($T_a=25^{\circ}C$)
Thermal resistance value	$R_{th(j-a)}$		80	190	$^{\circ}C/W$	

Switch characteristics(unless otherwise specified, $T_a = 40 \sim +85^{\circ}C$, $V_{SS} = 0V$, $V_{DD} = 4.5 \sim 5.5V$)

Parameter	Symbol	Minimum	Typical case	Maximum	Unit	Test condition
Propagation delay time	T_{flz}	-	-	300	ns	$C_1 = 15pF$, $P_{IN} \rightarrow P_{OUT}$, $R_1 = 10k\Omega$
Drop-out time	T_{thz}	-	-	60	μs	$C_1 = 300pF$, OUTR/OUTG/OUTB
Data-signalling rate	F	200	250	750	Kbps	
Input capacitance	C_i	-	-	15	pF	-

Communication data protocol:

The chip is compatible with DMX512 (1990) and its extended version, with data transmission rates ranging from 250kbps to 750 Kbps and adaptive decoding. The waveform diagram shows the chip's differential input configuration, where A represents the positive signal and B the negative signal.



Grade	Description	Least value	Representative value	Crest value	Unit
	Bit rate	200	250	500	Kbps
	Bit time	5	4	2	μs
S	Start bit	5	4	2	μs
D0~D7	Data bit	5	4	2	μs
T	2 stop bit	10	8	4	μs
1	Pre-reduction marking	0		1000000	μs



2	Reset signal	88		1000000	us
3	Reduction and marking	8		1000000	us
4	Field (Note1)	55	44	22	us
5	Percentage between fields	0		1000000	us
6	Packet length	1024		1000000	us
7	Repositioning signal interval	4096		1000000	us

Note1: The field consists of 11 bits, including a 0 start bit, 8 data bits, and 2 stop bits. The 0 start bit is low, the stop bit is high, and the data bits are 0, indicating a low level during the corresponding time period; they are 1, indicating a high level during the corresponding time period. The duration of the 0 start bit, stop bit, and data bits must be the same.

IC receiving instructions:

1. When the reset signal appears on the AB line, the IC enters the receive ready state. The address counter is reset to 0.
2. The first field in a data packet serves as the start field, containing 8 bits of data that must be "0000_0000". This field is not used for display purposes. Valid display fields begin from the second field, which in a 512-byte packet marks the first valid data field. IC supports adaptive data transmission rates ranging from 200K to 750K. While field durations vary with different rates, the key requirement is that all valid fields must have the same duration as the start field, regardless of whether the transmission rate is 250K or 500K.
3. The IC extracts corresponding fields from the 512-byte data packet based on its E2 address. For example, when the chip address is 0000_0000_0000, extraction begins at the first valid field; for address 0000_0000_0001, it starts at the second valid field. All extracted fields are forwarded, totaling 128 fields.

function declaration

Write code description:

Auto code: When the automatic code writing function is enabled, the controller doesn't need to send code-writing commands. Upon power-on, the IC automatically transmits code-writing data to subsequent lighting fixtures. This system employs [patented intelligent multi-algorithm error detection](#) technology to effectively prevent incorrect address reception. It significantly simplifies both installation and maintenance processes. During installation, no code-writing is required throughout the procedure. After replacement of faulty fixtures, the new units instantly receive valid addresses automatically.

Note: To prevent uncontrolled addresses beyond the controller's default range, the maximum address recognition in automatic code writing mode is 1501. Addresses exceeding 1501 are automatically assigned the default value 1501 by the IC. For example, in a 4-color 8-segment line display, the maximum address is 1501, resulting in a maximum channel count of $1500+24=1524$. Line lights beyond address 1501 are synchronized with the actual 1501 address because the IC defaults them to 1501.

The UCS512K series (including compatible 512G and 512H series with automatic code writing) is designed to eliminate manual code writing throughout the entire engineering installation and after-sales process. In practical applications, it addresses the challenge of obtaining the address of the first light (PI suspended) after installation. The system supports the following modes for address acquisition:

1. In engineering applications, the UCS512K series automatic code-writing lamps utilize a front panel system. The front panel is positioned in front of the main lamp and can be either a small module (made with UCS512H0L) or a special connector (with built-in UCS512H0L).

The first board automatically transmits its address to the first light via its address-writing function, enabling automatic address acquisition. The first board's address is typically pre-programmed as the first light's address (usually address 1, though other addresses may also be used) before leaving the factory.

Note 1: The first light refers to the PI-lamp suspended before the first board connection, not necessarily the first light connected to the controller port. The differential line output from the controller port can be connected to either the first or the last light.

Note 2: The first board of UCS512H0L placed between the lamps will not affect the normal operation of the lamps or the automatic code writing.

2. Without using the first board, the project manually writes the address for the first light, while the subsequent lights are automatically programmed. The downside of this approach is that the code must be written once after installation, but once the first light's address is set, no further code writing is required.
3. Before leaving the factory, all lamp addresses are uniformly written to the first lamp address (typically address 1) through parallel address writing. The drawback of this method is that once the parallel address writing is completed, it cannot be reconfigured or powered on again. Otherwise, the addresses will be automatically reprogrammed, making it impossible to maintain the original addresses written during the parallel address writing process.
4. For standard lighting fixtures rated at 512KH/L, complete the first address documentation, apply proper markings, and install them at the designated first light position.

Manual code entry:

1. Cascade write code: A conventional write code method that allows writing different addresses to each IC, provided the write code lines are functioning properly.
2. Parallel write code: All ICs on a bus write to the same address. A faulty write code line does not affect address writing. Automatic write code is not initiated after writing; it starts automatically after running the screen or a power cycle (automatic write code enabled).
3. Self-channel programming: The UCS512K series supports writing different self-channel numbers based on the number of segments in the lighting fixtures. When using the self-channel programming function, simply input the first address on the controller to program all connected fixtures with different segment numbers in one go.

Write parameter description

The UCS512K series supports two write parameter modes: cascaded and parallel.

Advantages and disadvantages of cascade write parameters: You can write different parameter values to each IC, but ensure the write line is functioning properly.

Advantages and disadvantages of parallel writing parameters: Only all ICs on a single bus can write the same parameter value, and a write line failure does not affect parameter writing.

Parameter Model Correspondence Table

Comparison of parameters and factory defaults across different models				
Parameter	Scope	Factory default		
		UCS512KH	UCS512KHB	UCS512KLB
Number of channels	1-128	24	24	24
Enable automatically	Turn on/off	Open	Open	Open
Color selection	1-7	3	3	3
Packet forwarding count	1-32	1	1	1
Forwarding protocol	UCS9812 UCS8903/4 UCS2903/4/12 UCS7804/7904/UCS7604/7612/7606	UCS9812	UCS7904/7604/7606/7612/7614/7624/8612/8606	UCS2903/4/12
Turn on the light	Address line detection mode/Custom grayscale	Address line detection mode	Address line detection mode	Address line detection mode
1.5S No signal	Keep the last frame or restore the power-on light	Restore power and light	Restore power and light	Restore power and light
Current range	UCS7804/7904: Grades 1-64; UCS9812/7604/7612/7606/7614/7624/8612/8606: Grades 1-16	64 16	64 16	64 16
Channel forwarding count	1-128	1	1	1
Channel forwarding order	Custom, Standard Order	Standard order	Standard order	Standard order

**Write parameter lighting status:(unsuccessful or black)**

Write address	Overall writing	Address is 1	R
		The address is not 1	G
	Cascade write / self channel write		Headlight: RG;Non-headlight: ALL
Write light parameters	Address line detection mode is enabled	Address line detection mode	
	Address line detection mode is not enabled	Light up the gray scale	
Write AutoCode	Overall writing	Write as Auto:RB; Write as Man: ALL	
	Cascade write	First light	RG
		Non-primary lamp	Write as Auto:RB; Write as Man: ALL
Number of write channels Number of colors in a section Write forwarding count Write current mode for transfer type Write channel forwarding count Write channel forwarding order	Overall writing	ALL	
	Cascade write	Headlight: RG;Non-headlight: ALL	

Note 1: The above light gray levels are 20%-30%. ALL indicates all channels are on.

Parameter Description:**Turn on the light****Address line detection mode:**

Turn off automatic code generation: Light RG

When automatic code generation is enabled: If no first board is added, the first light illuminates RG, followed by R.

The first board is added before the first light, which turns on G, followed by R.

When the write line is faulty (whether short circuit or other faults), the RG light will be lit, and the light will change dynamically with the fault. If the light color changes unpredictably, it indicates a hidden fault. The address line detection mode is mainly used in conjunction with automatic writing, and the light will indicate the fault point of the address line.

Custom gray scale mode: All ports can be independently set to grayscale values

1.5S No signal light: Keep the last frame and restore power-on lighting is optional

Number of channels: The channel number setting is designed to work with the self-channel cascading write code and automatic write code functions.

Segment color count: The UCS512K series supports 1-7 segment color configurations, enabling versatile lighting applications with customizable color combinations. This is a must-have feature.

Predefined parameters.

Forward count: The application of multi-segment lamps with fewer segments can be realized by parameter setting. For example, the pre-made 8-segment lamp can be used.

This function can be used in the project which only need one section, and the parameter can be set to 8, so that the data of one section can control the lamps of eight sections. This function can reduce the number of drawing boards and the variety of inventory boards.

Channel forwarding count: It can be used for multi-channel parallel expansion, and can also be flexibly used when the IC channel is not fully utilized. Within the predefined number of colors, each color can individually define the number of channels to be connected in parallel (1-128).

Channel forwarding order: This parameter allows you to set the forwarding order of different colors (color combinations) within a segment. It enables you to configure lamps with different wiring sequences (e.g., RGB, W1, W2, W3, W4) to ensure compatibility between lamps with different wiring orders.

Current level: The current setting for UCS9812/UCS7604/7606/7612/7614/7624/8612/8606 features 16 adjustable levels. The UCS7804/7904 is a 64-level configurable device.

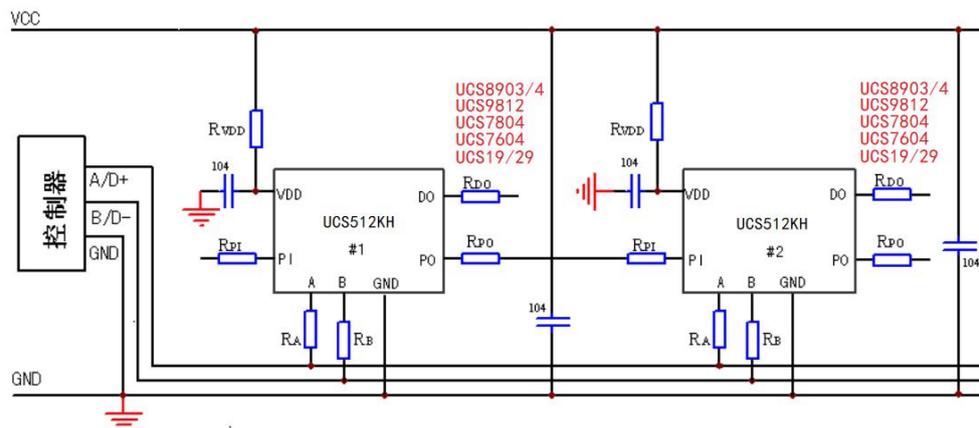
Forwarding channel limit:

The UCS512K series can expand the number of channels it can control during forwarding by adjusting the channel forwarding count and segment forwarding count. To ensure the forwarding time does not exceed 16ms at a frame rate of 60Hz (16 ms per frame), the UCS512K imposes the following limits on the number of forwarding channels:

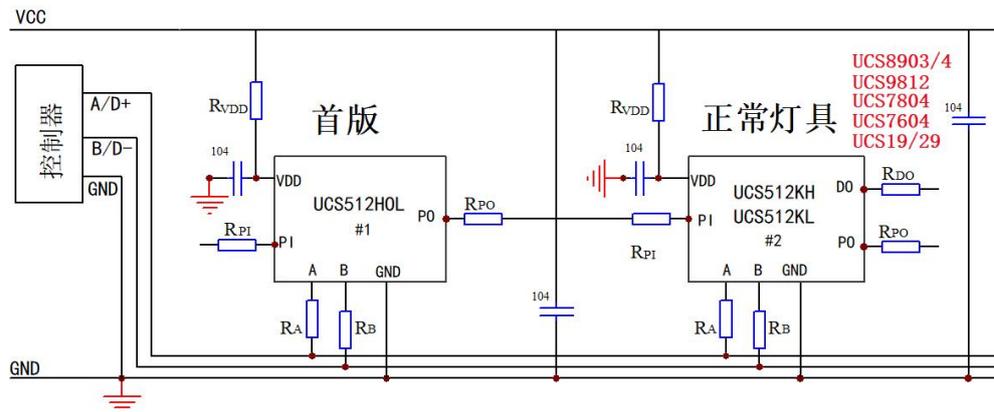
1. Maximum forwarding channels for UCS19/29 series: 1024
2. Maximum forwarding channels for 7604/7606/7612/7804/7904/7614/7624/8612/8606: 1024
3. Maximum forwarding channels for 8903/4: 512
4. Maximum forwarding channels for 9812: 512

Note: The maximum forwarding channel count does not refer to the number of video channels, but to the total number of channels calculated by multiplying the number of video channels by the channel forwarding count and the segment forwarding count. For example, if the forwarding count per channel is set to 8, the segment cycle count is 2, and the forwarding model is 2903, the actual number of video channels allowed for forwarding is: $1024 \text{ (maximum forwarding channel count)} / 8 / 2 = 64$.

Application Figure 1: UCS512KH forwarding diagram



Application Figure 2: Schematic diagram of UCS512H0L as the first plate



Suggestion Table of Component Selection

Element /VCC	48V	36V	24V	12V	5V
RVDD	4.7K	3.3K	2K	750	82
RPI	750	600	500	500	500
RPO	750	600	500	500	500
RA	10K	5K-10K	5K-10K	5K-10K	5K-10K
RB	10K	5K-10K	5K-10K	5K-10K	5K-10K
RDO	120	120	120	120	Not have

Note: When the supply voltage exceeds 12V, ensure proper power matching between the RA/RB package and resistance values to prevent overcurrent damage to RA/RB if the AB lines are mistakenly connected to 24V. To reduce the IC's dynamic power consumption, increasing the RVDD value can decrease IDD current. However, IDD must be maintained at 5mA under the lowest voltage conditions after long-distance power transmission.

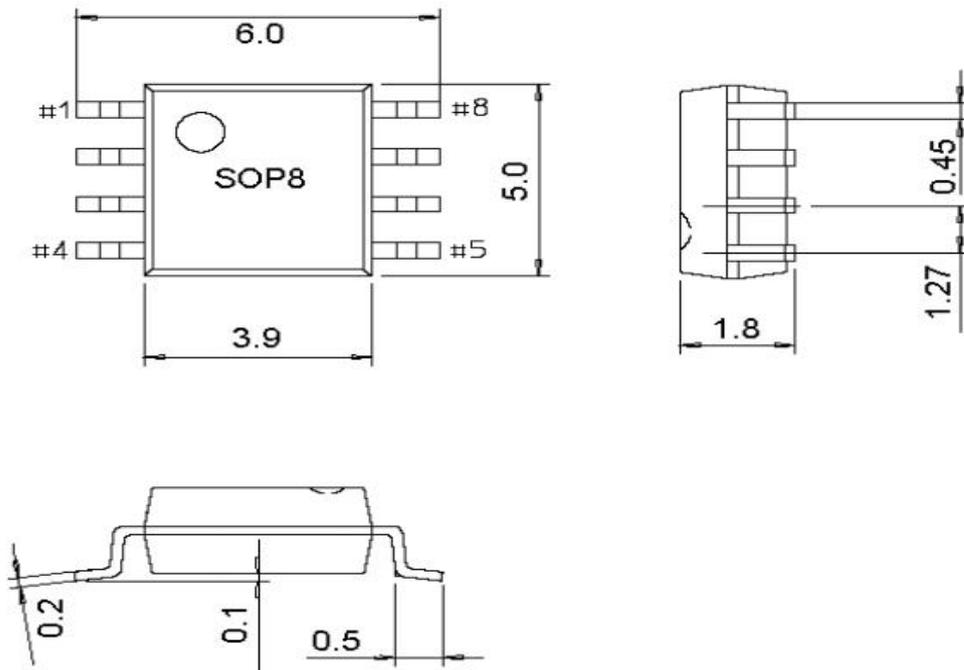
Explanation of recommended values in component selection table

1. The RVDD value is set as a general recommendation. Since most lighting fixtures use parallel multi-lamp configurations with single or dual power supplies, the voltage at the lowest point of the circuit may be significantly lower than the primary power supply's VCC voltage. For example, if the primary power supply's VCC is 24V, the VCC voltage at the lowest point of the fixture might drop to 20V or below. The RVDD values in the table are primarily designed to ensure sufficient operating current for the IC at the lowest voltage point under normal conditions, without considering static power consumption. For applications requiring lower static power consumption, the RVDD value should guarantee at least 4mA of operating current at the lowest voltage point. Formula: $I_{VDD} = (VCC - 5.5V) / RVDD$

2. In the component selection table, VCC denotes the external power supply input voltage of the lamp, not the voltage after internal step-down conversion. Therefore, all component values in the table should be referenced to VCC voltage. The RVDD value is determined by the direct voltage draw from VCC, independent of the output voltage from the internal step-down circuit. If RVDD requires voltage from the step-down circuit's output instead of VCC, its value should be determined by the step-down voltage rather than the VCC value in the table. For example, if VCC is 24V and the internal step-down voltage is 12V, RVDD should be set to 12V when connected to the step-down output.

Encapsulation shape and size

SOP8


Version Number

Edition	Date of issue	Revision Summary
VER1.0	2022-1-15	First edition release
VER1.1	2022-2-20	Add UCS512KHB
VER1.2	2024-1-18	Replace UCS512KL with UCS512KLB
VER1.5	2024-7-31	Increase forwarding model
VER1.6	2024-11-26	Description of the additional component selection table