GS8526

DMX512 4-Channel Constant Current LED Driver Chip

Product Description

The GS8526 is a four-channel, parallel DMX512 differential signal transmission LED constant current drive chip. It features four open-drain constant current outputs, built-in grayscale pulse modulation capability, and accommodates an input power supply spanning from 8V to 30V, withstanding a port voltage of 30V. The chip integrates a 16-bit GAMMA correction module and supports a maximum PWM refresh frequency of 9.5 kHz. Furthermore, it provides an output channel current misalignment processing method that effectively reduces electromagnetic interference and power supply noise. The GS8526 employs extended DMX512 encoding as its signal transmission method, with a transmission frequency ranging from 200 kHz to 850 kHz. The chip automatically decodes and can control the output current on a channel-by-channel basis, allowing for unlimited cascading. Additionally, the chip comes equipped with a built-in EEPROM, supports online coding, and incorporates power-on and power-down protection functions to enhance its operational lifespan. The GS8526 is available in SSOP10 and SOP16 packages and operates within a temperature range of -40°C to +85°C.

Applications

- LED point light source, line light, and soft light strip
- LED decorative illumination and lighting engineering

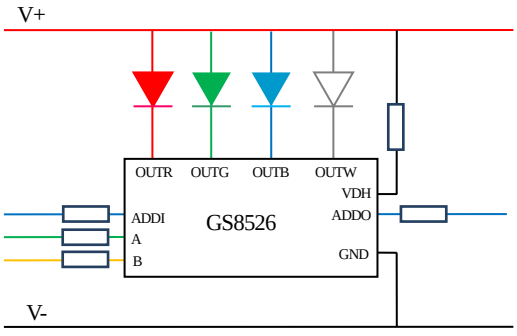
Features

- The chip has a built-in 7805, with an operating voltage of 8V to 30V
- The predetermined output current is 17.8 mA, encompassing a current range of 4.6 to 26.5 mA. Additionally, there are 16 levels of adjustment, allowing for the independent configuration of each channel's current, which can be preserved in the event of a power failure
- Using DMX512 encoding and decoding, the parallel data frequency ranges from 200 kHz to 850 kHz
- Data transmission of 8 bits, internal GAMMA correction of 16 bits, GAMMA2.2, grayscale level 65536
- Built in PWM pulse regulation technology, with a maximum refresh rate of 9.5kHz for PWM
- The grayscale smoothing function facilitates a gradient display effect characterized by smooth and delicate transitions
- Automated address generation eliminates the necessity for manual address writing operations
- Support the detection of virtual welding on address lines and data lines in order to enhance the efficiency of production testing
- The default LED color is an optional feature upon power activation, and either the last displayed frame or the preset default color may be retained in the absence of a signal
- ESD: 4 kV

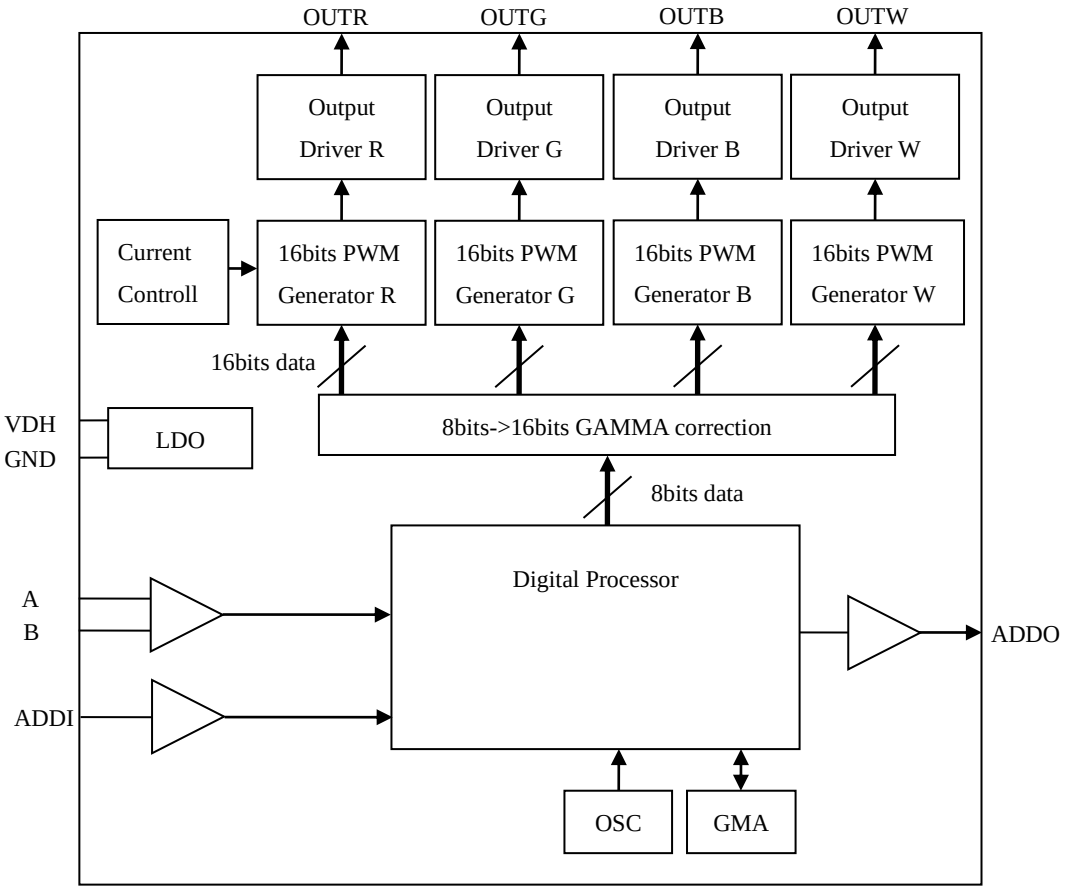
Device Information

Part Number	Package	Body Size (Nom)
GS8526	SSOP10	4.90mm * 3.90mm
	SOP16	9.90mm * 3.90mm

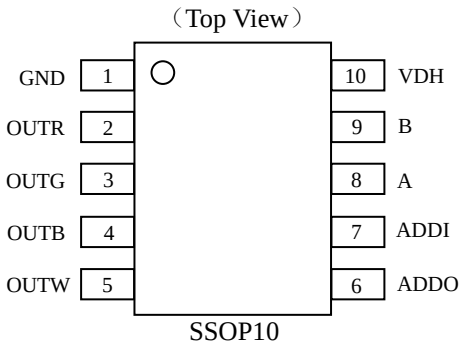
Typical Application Diagram

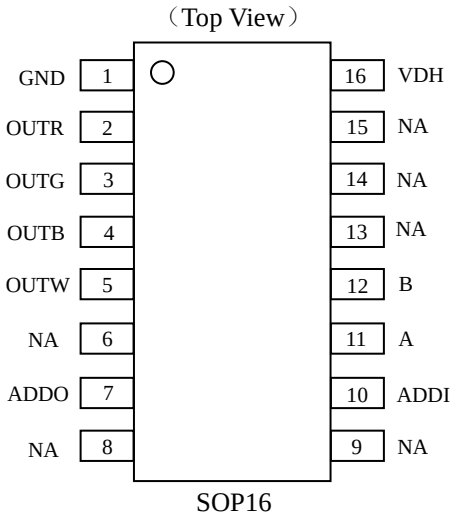


Functional Block Diagram



Pin Configuration（GS8526）



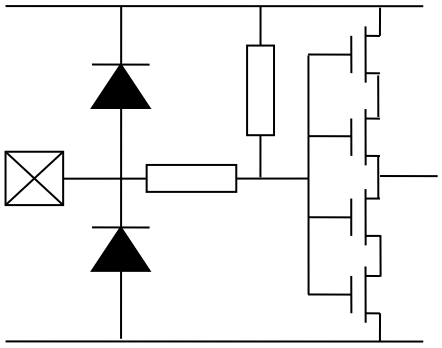


Pin Configuration

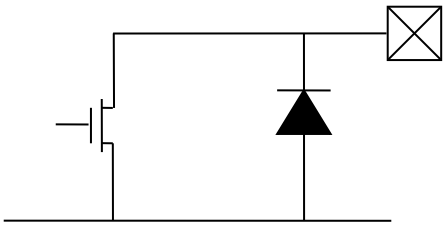
Pin			Attribute	Description
Pin Name	**SSOP10**	**SOP16**		
GND	1	1	G	Chip ground
OUTR～OUTW	2,3,4,5	2,3,4,5	O	Constant current output terminal
NA	-	6	-	Empty foot position
ADDO	6	7	O	Address output terminal
NA	-	8,9	-	Empty foot position
ADDI	7	10	I	Address input terminal
A、B	8,9	11,12	I	Differential signal terminal
NA	-	13,14,15	-	Empty foot position
VDH	10	16	P	Supply voltage terminal

Equivalent Circuits of Inputs and Outputs

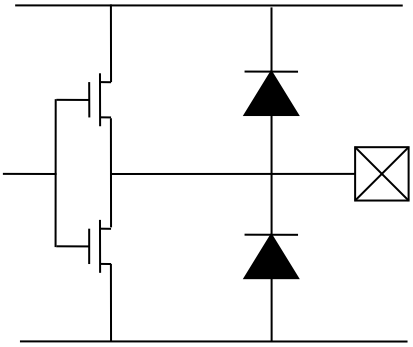
1. ADDI terminals



2. OUTR/OUTG/OUTB/OUTW terminals



3. ADDO terminals



Maximum Rating

Characteristic		Symbol	Rating	Unit
Supply Voltage		V_{DH}	-0.4～30V	V
LDO Output Voltage		V_{CC}	-0.4～6V	V
Input logic voltage		V_{IN}	-0.5～VCC+0.5	V
Output Current per Output Channel		I_{OUT}	26.5	mA
Output terminal withstand voltage		V_{DS}	30	V
Ground terminal current		I_{GND}	115	mA
Heat dissipation	SSOP10	P_D	0.4	W
	SOP16		0.6	
Operation Ambient Temperature		T_{OP}	-40～85	℃
Storage Temperature		T_{STG}	-55～150	℃
ESD Rating		HBM	4000	V

（1） The nearer the operation approaches the maximum range value, the lesser the reliability of the chip, and the shorter the duration of its lifespan. Operating beyond the established maximum limit will result in irreversible damage to the components. It is noteworthy that these values are merely partially specified and do not accommodate functional operations under conditions that deviate from the outlined specifications.

（2） All voltage values are referenced to the ground terminal as the point of reference.

Electrical Characteristics（VDH=24V，Ta=25℃）

Characteristics		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage		V_{DH}		8	24	30	V
Internal Supply Voltage		V_{CC}			5.5		V
Logic high input voltage		V_{IH}		0.7*V_{CC}		V_{CC}	V
Logic low input voltage		V_{IL}		0		0.3*V_{CC}	V
Differential signal common-mode range		V_{CM}	V_{DM}=200mV	-5		12	V
Differential signal differential mode range		V_{DM}		200			mV
Output terminal (OUTx) voltage range * 4		V_{DS}			1.2	30	V
Output terminal (OUTx) leakage current * 4		I_{OH}	OUTx=Close OUTx=30V			1	μA
Output current (built-in)		I_{OUT}	V_{DH}=24V	4.6	17.8	26.5	mA
Quiescent current		I_{chip}	V_{DH}=24V		2.8		mA
Power consumption	SSOP10	P_D	Ta=25℃			250	mW
	SOP16					480	
Current offset (channel)		dI_{OUT}	I_{OUT}=17.8mA		±1.5%	±3%	%
Current offset (chip)		dI_{OUT2}	V_{OUT}=1.2V		±3%	±5%	%
Current Offset vs. Output Voltage		%/dV_{DS}	V_{DS}=1V-3V		±0.1%	±0.3%	%/V
Current offset VS. Supply Voltage		%/dV_{DH}	V_{DH}=12V-24V		±0.1%	±0.3%	%/V

∗1 The formula for the channel-to-channel current offset is defined as follows：

$$\triangle(\%) = \left[\frac{Iout_n}{\frac{(Iout_0 + Iout_1 + \cdots + Iout_3)}{4}} - 1\right] * 100\%$$

∗2 The formula for chip-to-chip current offset is defined as follows:

$$\triangle(\%) = \left[\frac{\frac{(Iout_0 + Iout_1 + \cdots + Iout_3)}{4} - (Ideal\ Output\ Current)}{(Ideal\ Output\ Current)}\right] * 100\%$$

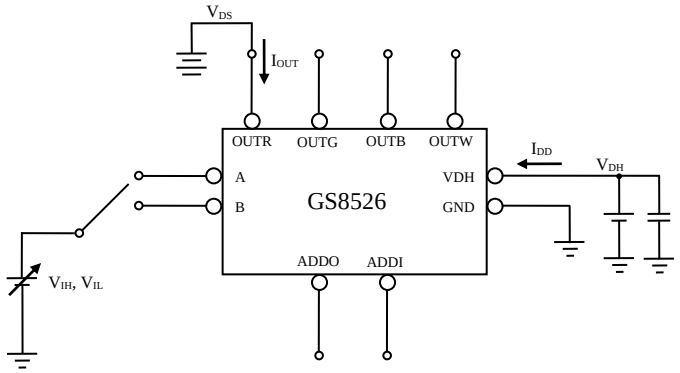
∗3 The offset formula for the output current to the change in the supply voltage is defined as follows:

$$\triangle(\%/\mathrm{V}) = \left[\frac{Iout_n(@V_{DH} = 24V) - Iout_n(@V_{DH} = 20V)}{Iout_n(@V_{DD} = 20V)}\right] * \frac{100\%}{24V - 20V}$$

∗4 The formula for the offset of the output current from the change in the output voltage is defined as follows:

$$\triangle(\%/\mathrm{V}) = \left[\frac{Iout_n(@Vout_n = 3V) - Iout_n(@Vout_n = 1V)}{Iout_n(@Vout_n = 1V)}\right] * \frac{100\%}{3V - 1V}$$

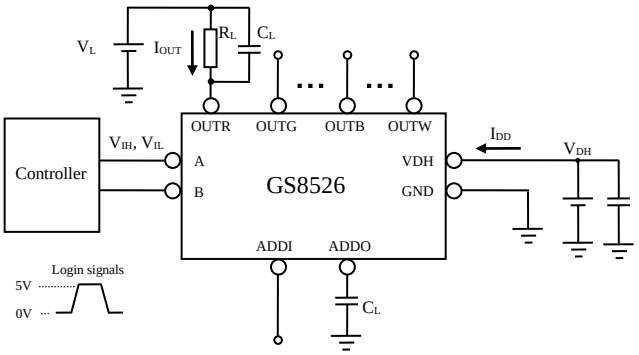
Test Circuit for Electrical Characteristics



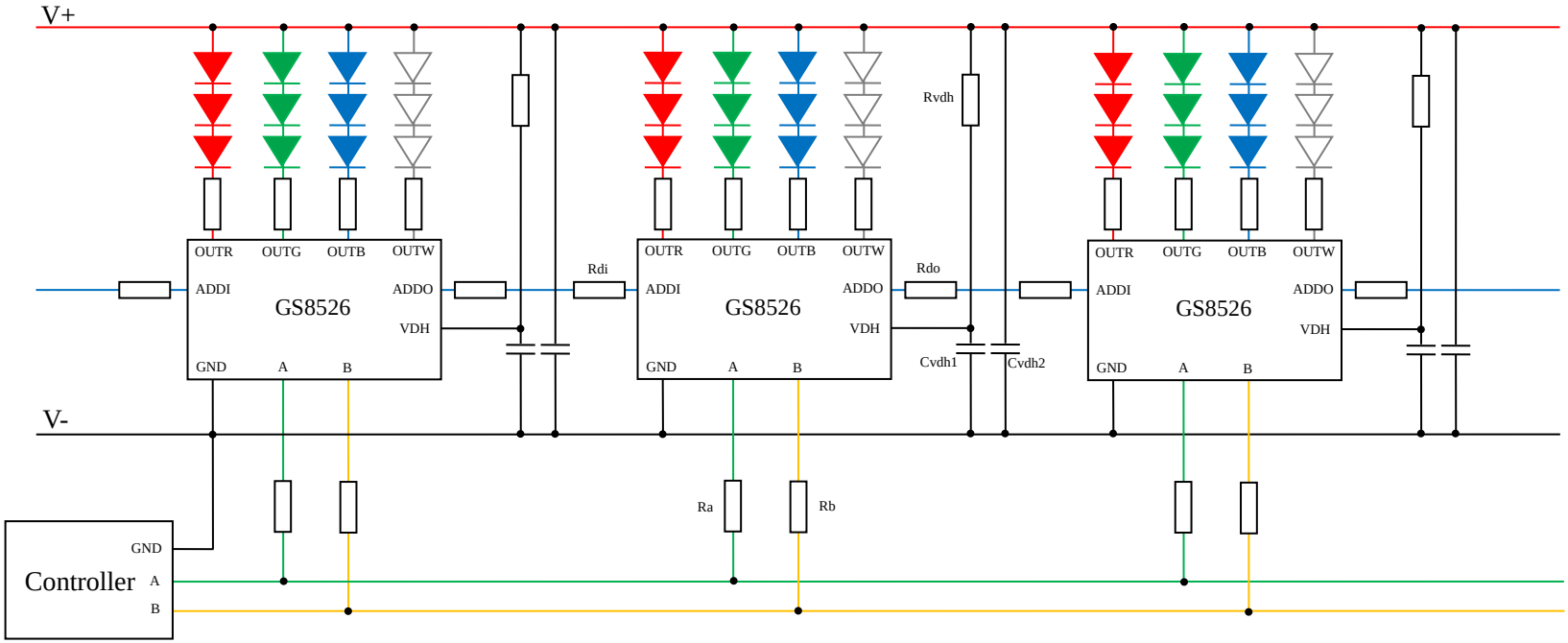
Switching Characteristics（VDH=24V，Ta=25℃）

Characteristics	Symbol	Condition	Min.	Typ.	Max.	Unit
Internal oscillator frequency	F_{OSC}			10		MHz
PWM refresh rate	F_{REQ1}	V_{DH}=24V	0.3	9.5		kHz
Data refresh rate	F_{REQ2}	V_{DS}=1V		30	1017	Hz
Data refresh delay time	t_{SUD}	V_{IH}=5V		NA		us
Channel output delay time	t_{COD}	V_{IL}=0V		100		ns
Current output rising time	t_{OR}	V_L=4V		40		ns
Current output falling time	t_{OF}	R_L=150 Ω		20		ns
PWM pulse duration	t_W	C_L=10pF		250		ns
Parallel data frequency	F_{DATA}		200	250	850	kHz

Test Circuit for Switching Characteristics



Typical Application Circuit

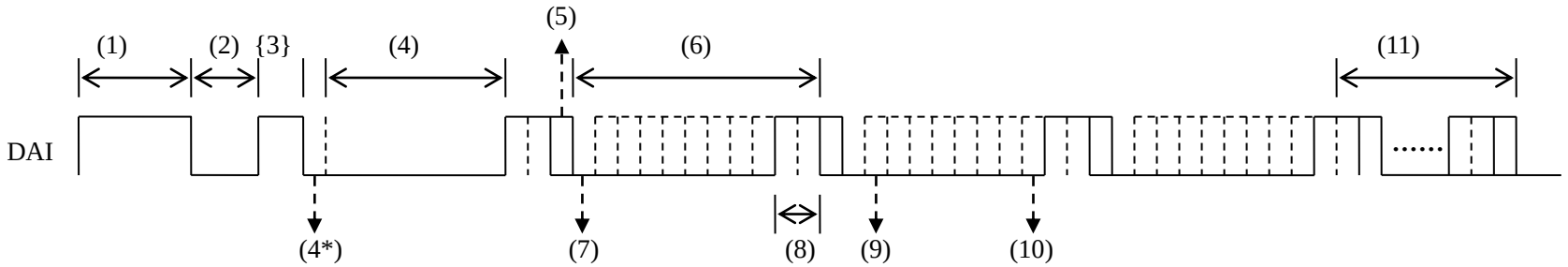


Component Selection Table:

Item	Rvdh	Rdi	Rdo	Ra	Rb	Cvdh1	Cvdh2
12V	510R	510R	510R	3.9K	3.9K	100nF(104)	100nF(104)
15V	1K	510R	510R	3.9K	3.9K	100nF(104)	100nF(104)
24V	2K	510R	510R	3.9K	3.9K	100nF(104)	100nF(104)

DMX512 Parallel Transmission Extension Protocol (Compatible With Standard Protocols)

This protocol adopts a simple asynchronous eight bit serial data protocol to describe the control method between the control system and the accessory devices. GS8526 is compatible with the standard USITT DMX512-A protocol and extends functions such as automatic addressing, high-speed data transmission, and long data display through command frames. The transmission speed is between 250k and 500k, and the length can be infinitely cascaded.



Number	Describe	Time Limit	Lower Limit of Time	Deviation
(1)	Pre reset signal (MBB)	0us~1s		
(2)	RESET (BREAK)	≥ 88us		
(3)	Mark after reset (MAB)	4us~1s		
(4)	Start Code (Field 0 data)	32us	16us	As an indicator of system speed
(4*)	Start Code(Field AAH data)	4us	2us	
(5)	Idle space occupied between fields	0~1s		
(6)	Field (SLOT)	44us	22us	
(7)	Start Bit	4us	2us	
(8)	Stop Bit	8us	4us	
(9)	Minimum Data Bit	4us	2us	
(10)	Highest Data Bit	4us	2us	
(11)	Number of fields in the data chain	No Restrictions		

No Signal Display Status

Should the GS8526 fail to receive the appropriate DMX512 signal within a time frame of 2seconds, the chip shall automatically transition to the no signal display state.

No signal display status can be configured through the controller, and the user can select one of the following three modes: turn off the indicator light, display the specified LED color after power on, or retain the last frame of screen display.

When the indicator light is turned off, GS8526 will turn off the LED output channel current; Keeping the last frame displayed on the screen, the chip will maintain the existing LED driving current output; After power on, the specified LED color is displayed by setting the chip RGBW channel 8-bit display data to obtain any grayscale combination, which meets the lighting requirements for engineering installation when the lamp is powered on.

Chip Field Mode

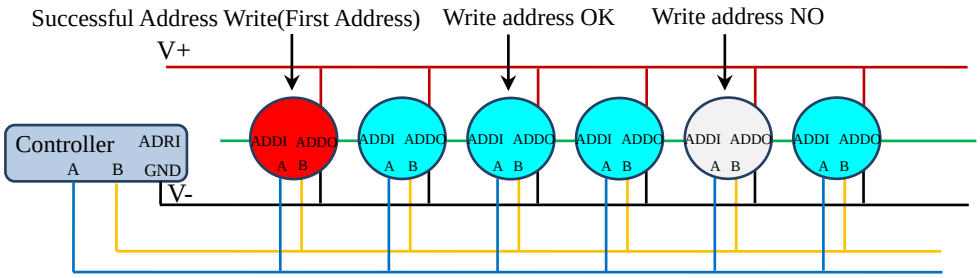
The fields of GS8526 are parameterized by the controller. By configuring different fields, the chip can achieve standard RGB or RGBW display effects. In addition, multiple constant current output interfaces can be connected in parallel to enhance current driving capability and provide flexible options for customer engineering. Through field selection, GS8526 can achieve a maximum constant current output of 106mA. At the factory, the default setting of GS8526 is the four field mode.

Mode	Channel Selection
1 field	Intercept 1 field, corresponding to RGBW
2 field	Intercept 2 fields, corresponding to RG and BW
3 field	Intercept 3 fields, corresponding to R, G, and B
4 field	Intercept 4 fields, corresponding to R, G, B, and W

DMX512 Address Initialization

When sending a write address command to the AB port of the chip using a parallel data cable, it is necessary to ensure that the address line of the first chip is in a floating state, or connect the ADDI interface to the ADRI port of the controller. Meanwhile, ensure that the address lines between each chip are connected properly, as shown in the following figure. After successfully writing the address, the first address chip will light up a red light, while other chips will display a green light. Chips that fail to write the address will remain off.

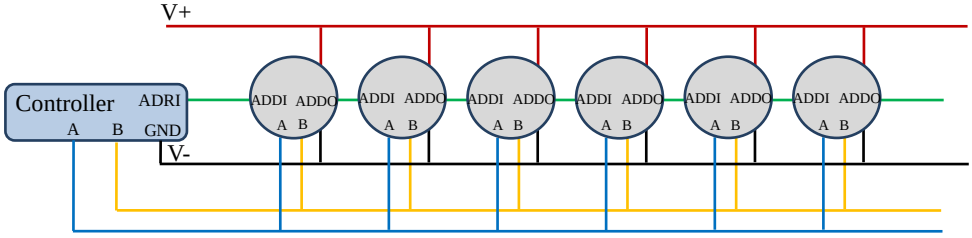
The address port of GS8526 has buffer forwarding function and can support a maximum length of 50 meters for address lines between any two points.



Automatic Coding

After enabling the automatic code writing mode, the chip will automatically complete the code writing according to the serial order of the address lines, eliminating manual operation. This feature significantly reduces the coding steps in the installation process of DMX512 lighting fixtures, achieving a simple installation mode comparable to series driven products, thereby greatly improving the efficiency of engineering installation and debugging. In addition, there is no need to confirm the address code or write the code when replacing faulty lamps in the later stage of engineering after-sales service. The lamps can automatically recognize and complete the coding steps, effectively reducing after-sales maintenance costs.

In automatic encoding mode, the first chip needs to connect the address line ADDI to the ADRI/PO+port of the controller. The address line length between the controller port and the first chip can reach 50 meters, without the need for customized first light board or zero field function for first light board applications.



- Engineering installation, debugging, and after-sales maintenance in automatic coding mode

    1. After the installation of the project is completed, the controller will send an overall jump/gradient display effect to troubleshoot display faults.
    2. Use color brushing/point by point running to display the effect and identify abnormal fault points in the address. When a malfunction is detected, there is no need to stop the screen or power off, and a new light fixture can be replaced directly.
    3. At the construction site, the lighting fixtures may have bad spots after prolonged operation, and maintenance is required at this time. Simply replace the faulty lighting fixtures with new ones, without the need to rewrite the code or power off, making the operation very simple.

- Automatic coding application production testing steps

    1. After activating the detection mode of the controller, the controller sets the first light to red, and other lights are displayed according to the selected effect (such as RGB jump, monochrome gradient, or white light constant). This mode helps to troubleshoot possible display abnormalities and issues such as AB signal or address line disconnection/virtual soldering (excluding the red warning on the first light), making it easier for maintenance personnel to quickly locate the source of the fault.
    2. After the troubleshooting is completed, turn off the detection mode to end the test.

ADDI、AB Port Virtual Soldering Detection

In virtual soldering detection mode, GS8526 performs real-time data integrity testing on ADDI address lines and AB signal lines. Once an abnormal situation is detected, the system will issue a warning through LED indicator lights. This mode can quickly locate the virtual solder joints of ADDI/AB lines during production or installation, facilitating timely troubleshooting and maintenance, thereby improving the reliability of product delivery.

Item	Display Effect
ADDI	Constant red light warning
A/B	Abnormal display

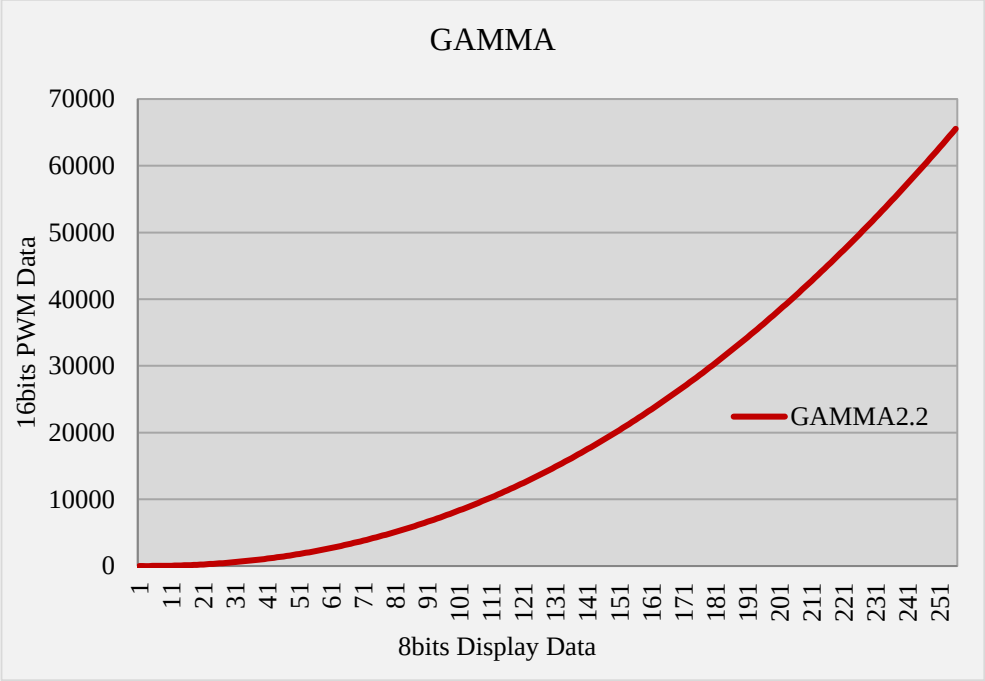
Grayscale Smoothing Function

GS8526 has grayscale smoothing function, which can be controlled through software and users can choose to turn it on or off. After enabling this feature, the gradient transition of the chip will be smoother and more delicate.

In the application scenario of building contours, the grayscale smoothing function will show a more significant effect.

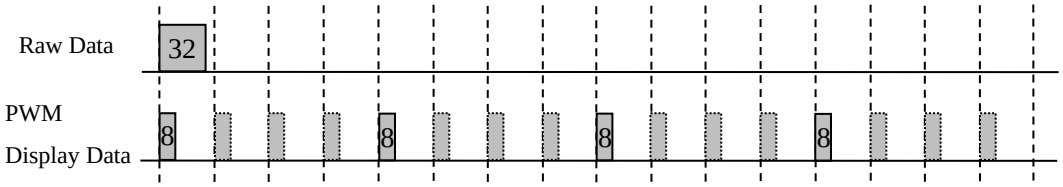
GAMMA 2.2 Calibration Technique

The chip integrates GAMMA 2.2 calibration function, which can convert 8-bit display data into 16 bit grayscale data through GAMMA module calibration. This 16 bit grayscale data can accurately control the current value output by the LED. By combining 16 bit grayscale with a 9.5kHz PWM refresh rate, the application requirements for high grayscale levels and high refresh rates are met.



PWM Output Modulation

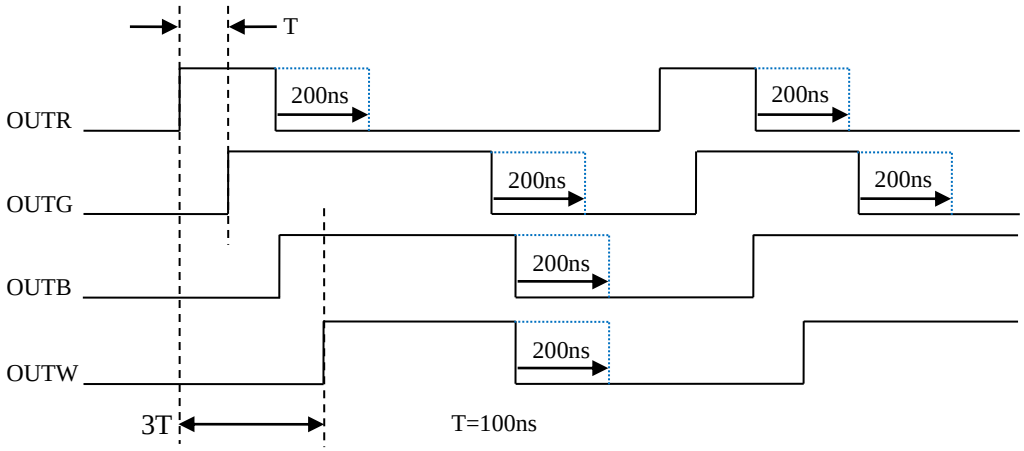
To improve the refresh rate of PWM output, GS8526 introduces MPWM technology, which evenly distributes the period N within the display time through a unique spreading method, as shown in the waveform below. The maximum refresh rate of the chip's PWM is 9.5kHz, and the minimum refresh rate is 300Hz, ensuring the softness of the display effect without affecting the accuracy of the output current.



PWM Interleaved Hysteresis Output

In order to reduce the interference of LED startup instantaneous current on the power supply and reduce voltage fluctuations on the power circuit, GS8526 has a built-in output hysteresis function. The output terminals OUTR, OUTG, OUTB, and OUTW will output current in sequence at intervals of 100ns, effectively reducing the impact on the power supply. In addition, the design of staggered output can also reduce the electromagnetic interference (EMI) radiation of the system, which helps to meet environmental requirements.

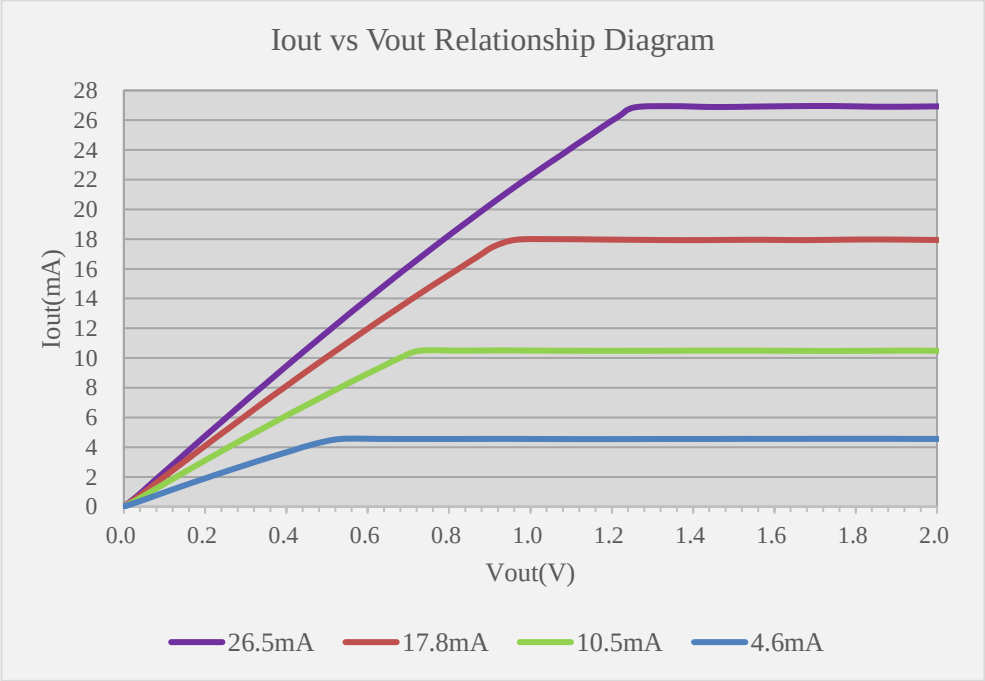
The PWM pulse width of GS8526 is widened by 200ns to compensate for the brightness loss caused by LED parasitic capacitance.



Output Current Regulation and Constant Current Voltage Range

The RGBW channel output current of GS8526 can be adjusted in 16 levels through software, ranging from 4.6 to 26.5 milliamps, with a factory default setting of 17.8 milliamps. Support independent setting of current for each RGBW channel to meet the adjustment requirements of white balance. In addition, the set current parameters will be stored in the chip to ensure that the settings can still be maintained after power failure. All adjustment modes of output current will not affect the grayscale performance of the display.

Set	Iout	Set	Iout	Set	Iout	Set	Iout
1	4.6mA	5	10.5mA	9	16.3mA	13	22.1mA
2	6.1mA	6	11.9mA	10	17.8mA	14	23.6mA
3	7.6mA	7	13.5mA	11	19.3mA	15	25.1mA
4	9.1mA	8	15mA	12	20.8mA	16	26.5mA



Undervoltage Protection Function

The chip has built-in undervoltage protection function, which will turn off the PWM output when the power supply voltage does not meet the working conditions, preventing abnormal working mode and improving system reliability.

Appendix I:Parameter Setting Items Configured by the Controller and Stored in the Chip

Function	Range	Factory Settings	Illustrate
Field Selection	1-2-3-4 Field	4 Field	The field is an independent optional item. After successfully setting the field, the first chip will display red, and the remaining chips will display blue.
No Signal State Setting	RGBW power on light up	Power on and light up, RGBW channels are both turned on with 25% brightness	Power on lighting: The brightness of the RGBW 4 channels can be independently set, with a single channel of 8 bits. The RGBW 4 ports can output any combination of brightness.
	Turn off the light		
	Keep the last frame		
Power on Lighting Setting	RGBW power on light up/ Power on and turn on the address light	RGBW power on light up	RGBW power on light up: When there is no signal after power on, the light up display is set according to the no signal state; Power on address light: When there is no signal after power on, the first light will turn red and the others will turn green.
4-bits Channel Current Regulation	4.6mA 6.1mA …… 17.8mA …… 25.1mA 26.5mA	17.8mA	Each channel has 16 independently adjustable current levels, with a range of 4.6-26.5mA, and can be saved in case of power failure
Write Code Mode	Manual/Automatic Coding	Manually write code	

Package Heat Dissipation Power

When four output channels are opened, the actual power consumption of the chip is determined by the following formula:

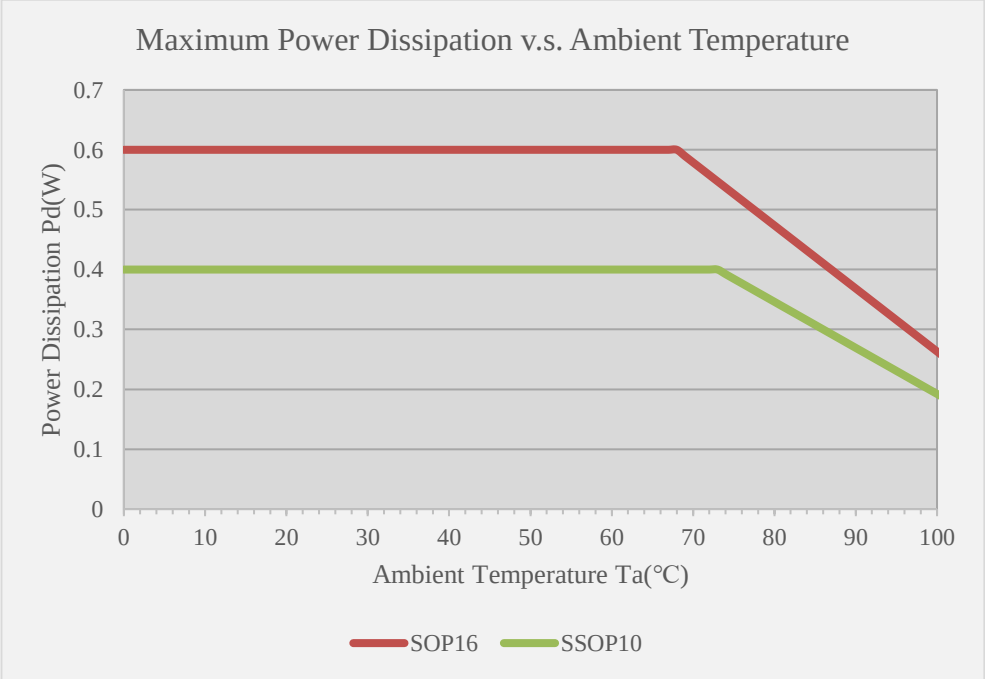
(Vout represents the output voltage when the current is turned on; Duty represents the proportion of time the current is turned on)

$$\text{PD(practical)} = V_{vdh}xI_{vdh} + V_{out3}xI_{out3}xDuty_3 + \cdots + V_{out0}xI_{out0}xDuty_0$$

In order to operate under safe conditions, the power consumption of the chip must be less than the maximum allowable power, which is determined by the ambient temperature and packaging type. The formula for maximum power consumption is as follows:

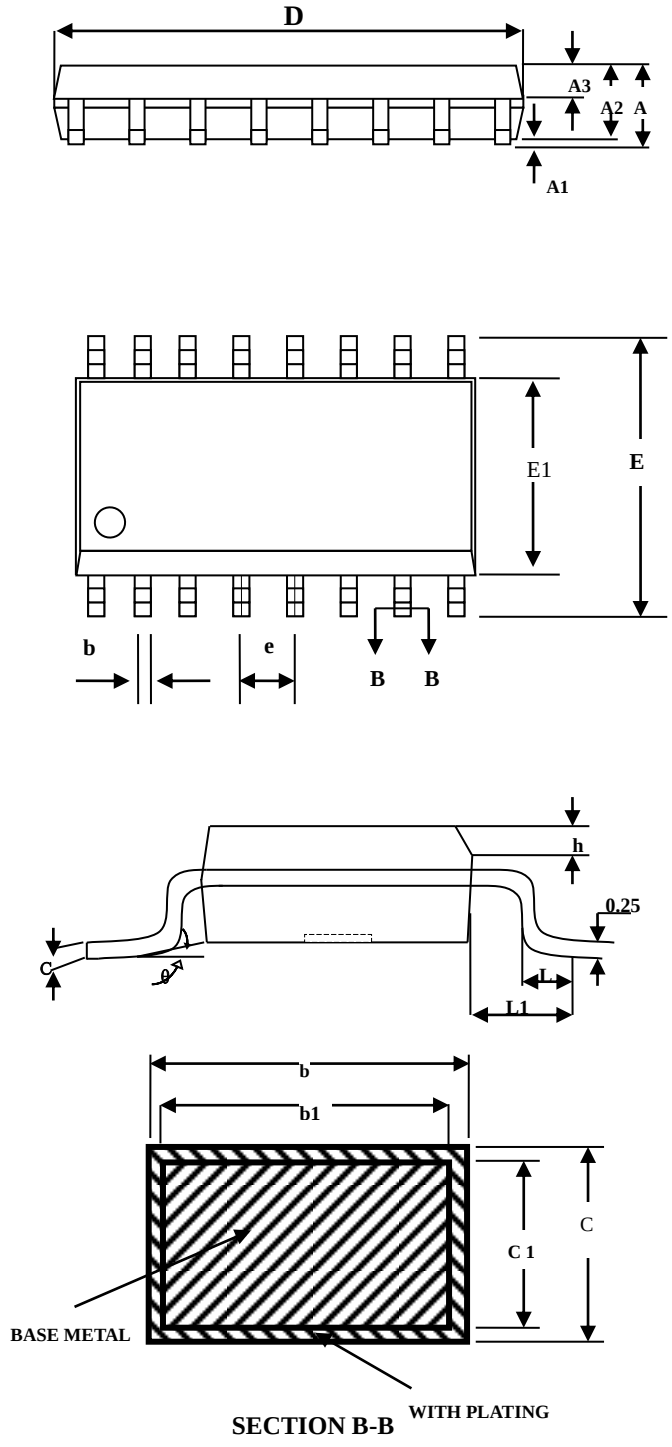
$$PD(max) = \frac{Tj(max)\,(\,℃) - Ta(\,℃)}{Rth(j-a)(\,℃/Watt)}$$

PD (max) will decrease with the increase of ambient temperature, so careful consideration should be given to the packaging form and ambient temperature when designing operating conditions. The following figure shows the relationship between maximum power consumption and ambient temperature for SSOP10 and SOP16 packaging.



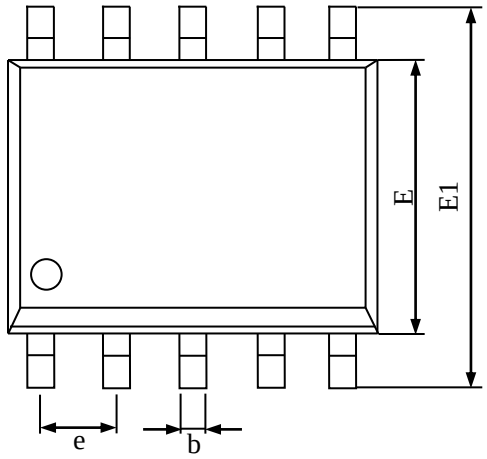
Packaging Dimensions

SOP16



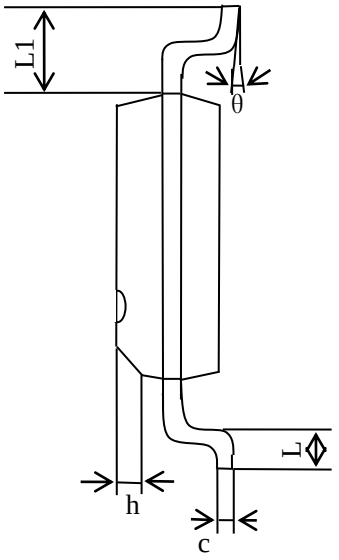
Symbol	Millimeter		
	Min.	Nom.	Max.
A	—	—	1.75
A1	0.05	—	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	—	0.48
b1	0.38	0.41	0.43
c	0.21	—	0.26
c1	0.19	0.20	0.21
D	9.70	9.90	10.10
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05BSC		
θ	0	—	8°

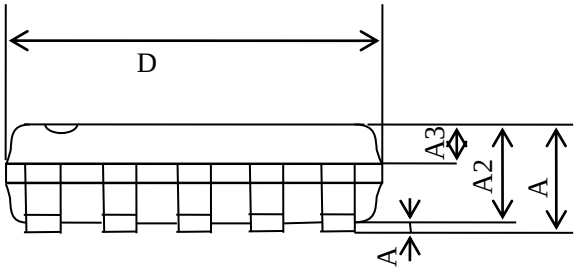
SSOP10



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	1.50	1.70
*A1	0.10	0.20
A2	1.35	1.45
A3	0.60	0.70
*b	0.30	0.50
c	0.19	0.25
D	4.80	5.00
E	3.80	3.95
*E1	5.80	6.20
*e	1.0(bsc)	
*L	0.55	0.75
*L1	0.99	1.10
θ	0°	8°
h	0.25	0.50

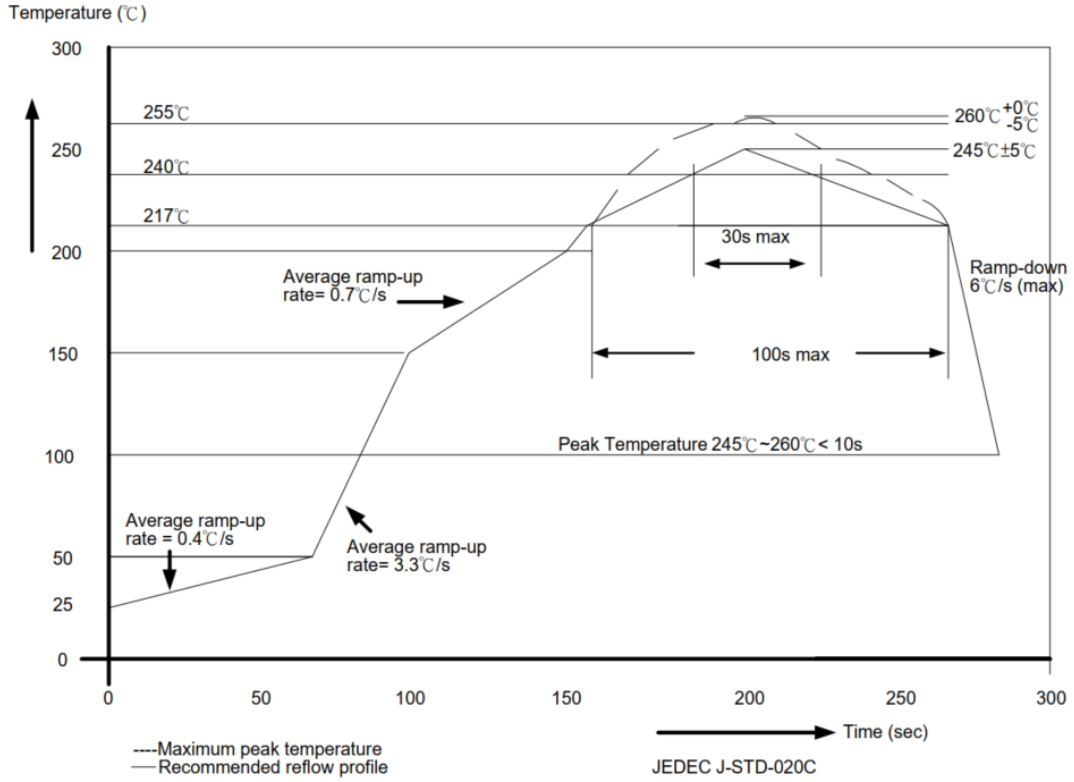
注：1，标注“*”尺寸为测量尺寸





Packaging Welding Process

The semiconductor products produced by Genesis Technology strictly comply with the European RoHS standard, and the soldering temperature of its packaging and soldering process meets the JEDEC J-STD-020C standard. The specific information is shown in the following figure.



Packaging thickness	Volume mm^3 ＜350	Volume mm^3 350-2000	Volume mm^3 ＞2000
＜1.6mm	260℃	260℃	260℃
1.6mm-2.5mm	260℃	250℃	245℃
＞2.5mm	250℃	245℃	245℃

The products listed in this specification are designed for applications in general electronic products, such as electrical appliances, visualization devices, communication products, and so on. Therefore, it is recommended that these products should not be used in medical facilities, surgical equipment, spacecraft, nuclear power control systems, disaster/crime prevention equipment, and similar devices. The improper use of these products may directly or indirectly pose a threat to people's lives or result in injury and property damage.

Genesis Technology will not be held responsible for any misuse of these products. Anyone who purchases any of the products described here and contains the intent or misuse mentioned above shall be fully responsible and liable for compensation. Genesis Technology, along with its distributors, managers, and employees, must defend themselves against all claims, lawsuits, damages, costs, and expenses arising from the aforementioned intentions or operations.