SM18512PS

Feature

- Built-in power regulator voltage stabilizing function, input power supply voltage: 5V~36V
- Compliant and extended DMX512 (1990) protocol
- Differential signal transmission rate:200kbps~750kbps
- The differential parallel signal transmission, support maximum 4096-channel addressing.
- Customizing OUT R/G/B/W port the default display effect
- The first chip lights up in red and the remaining chips light in green when succeeding writing address
- The first chip lights up in red and the remaining chips light in the preset lights when succeeding writing parameters.
- The first chip lights in red and the remaining chips light in yellow when succeeding writing current gain
- the first chip will light up in red, and the remaining light in purple after writing the automatic addressing/automatic addressing/adaptive function successfully
- OUT port opening width compensation 7 levels adjustable
- Address line open circuit self-check function
- No input signal for 2 seconds, switch the default display effect or maintain the last frame display state.
- Built-in 1/2/3/4 channel selection function
- OUT R/G/B/W each 5 bits current gain adjustment
- OUT R/G/B/W withstand voltage: 40V
- Built-in OTP
- Package: SSOP10

Application

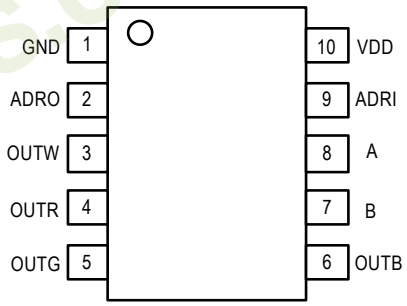
- LED decorative lighting indoor
- Architectural LED appearance / scene lighting
- Wash-wall lights, curtain screens
- Pointolite, LED hurdle lamp

Description

The SM18512PS is a 4-channel, parallel differential signal transmission LED driver, It is compatible and extends the DMX512 (1990) communication protocol. It has a variety of characteristics, including signal differential transmission, with a lot of load points, strong anti-interference ability, far transmission distance etc.

OUT R/G/B/W port output current 18mA and 32-level current gain of OUT R/G/B/W can be set separately through the controller parameters. At the same time, the PWM refresh rate of OUT port 4KHz greatly improves the refresh rate of the screen.

Pin Diagram



SSOP10

Internal Function Diagram

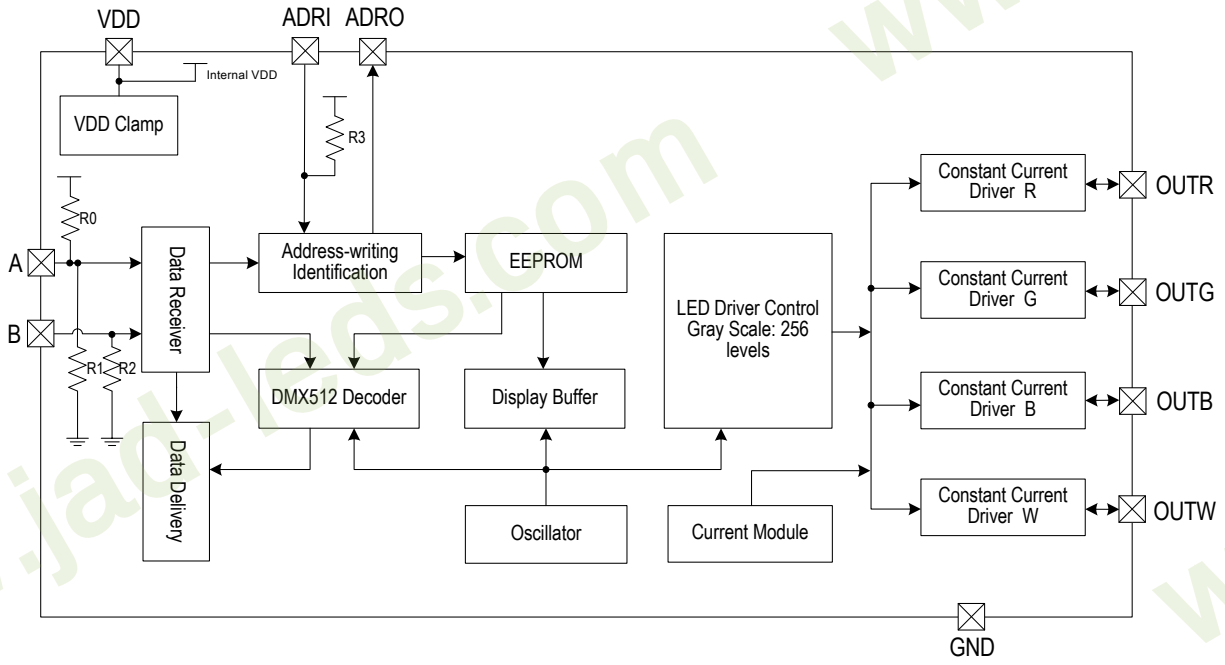


Fig.SM18512PS Internal function diagram

Pin Description

Pin Name	Pin Description
B	Differential signal input port-
A	Differential signal input port+
ADRI	Enable signal input port of writing address
VDD	Power supply port, built-in 5V LDO circuit
GND	Ground
OUT W/R/G/B	Constant current driver port
ADRO	Enable signal output port of writing address

Order Information

Type	Package	Packing		Reel Size
		Tube	Tape	
SM18512PS	SSOP10	100000 pcs/box	4000 pcs/tape	13 inches

Absolute Maximum Parameter (Note 1)

Unless otherwise stated, T_A=25°C.

Symbol	Parameter	Range	Unit
V_{DD}	Operating voltage	-0.4~5.5	V
V_{IO}	Logic input voltage	-0.4~VDD+0.4	V
BV_{OUT}	OUTR/G/B/W withstand voltage	45	V
I_{OUT}	OUTR/G/B/W maximum output current	22	mA
I_{clamp}	Maximum clamping current of VDD port	20	mA
$R_{\theta JA}$	PN junction to ambient thermal resistance (Note 2)	90	°C/W
P_D	Power consumption (Note 3)	0.9	W
T_J	Operating junction temperature	-40~150	°C
T_{STG}	Storage temperature	-55~150	°C
V_{ESD}	HBM ESD	2	KV

Note 1: The maximum output power is limited to chip junction temperature, the maximum limit means that the chip can be damaged beyond the scope of the work. The maximum limit value is the work in the limit parameter range, the device function is normal, but it is not completely guaranteed to meet the individual performance indexes.

Note 2: $R_{\theta JA}$ measures the flow of water according to the JEDEC JESD51 thermal measurement standard on the single-layer thermal conductivity test board under T_A=25°C.

Note 3: The maximum power consumption is decreased when temperature rising, this depends on T_{JMAX}, $R_{\theta JA}$ and T_A Maximum allowable power consumption is $P_D = (T_{JMAX}-T_A)/ R_{\theta JA}$ or the lower value of the value given in the limit range.

Electric Operating Parameter (Note 4, 5)

Unless otherwise stated, V_{DD}=5V, T_A=25°C.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
V_{DD}	Internal clamp voltage	External power supply: V_{CC}=12V, R_D (current-limit resistor between VCC and VDD) =1KΩ	4.8	5.2	5.4	V
I_{DD}	Quiescent current(energy saving mode)	V_{DD} = 5V, I_{OUT} "OFF"	-	3.8	-	mA
	Quiescent current(working mode)	V_{DD} = 5V, I_{OUT} "ON"	-	5.1	-	mA
I_{OH}	DAO drive	DAO high output, connects to GND	-	-37	-	mA
I_{OL}		DAO low output, connects to VDD	-	36	-	mA
I_{OUT_RGBW}	OUT R/G/B/W output current	Current gain: D5:D4:D3:D2:D1=11111	-	18	-	mA
dI_{OUT_RGBW}	OUT R/G/B/W output current accuracy	I_{OUT}=18mA	-	±3	-	%
R_{down_AB}	Resistance to ground of A/B port	VDD=4.5V	-	200	-	KΩ
R_{UP_A}	Pull-up resistor of A port	VDD=4.5V	-	250	-	KΩ
V_{CM}	Differential-input common-mode voltage	-	-	-	12	V
I_{AB}	Differential-input current	-	-	-	28	uA
V_{TH}	Differential-input threshold voltage	VDD = 5V,B=2.5V,A input high and low level.	-200	-	200	mV
$\triangle V_{TH}$	Differential-input hysteresis voltage	VDD = 5V,B=2.5V,A input high and low level.	-	80	-	mV
V_{DS_S}	I_{OUT} constant current knee point voltage	I_{OUT} = 18mA	-	0.3	-	V
% VS V_{DS}	OUT R/G/B/W output current variation	I_{OUT} =18mA, V_{DS}=1~3V	-	1	-	%
%VS V_{DD}		I_{OUT} =18mA, V_{DS}=4.5~5.5V	-	1	-	
%VS T_A		I_{OUT} =18mA, T_A =-40~+85℃	-	4	-	
R_{UP_ADRI}	ADRI pull-up resistor	-	-	23	-	KΩ
T_{OTP}	Initiate junction temperature of over temperature protection	-	-	135	-	℃
I_{leak}	OUT R/G/B/W leak current	I_{OUT}"OFF", V_{DS} = 40V	-	-	1	uA

Note 4: The electrical operating parameters define the DC parameters of the device within the working range and under test conditions that ensure a specific performance indicator. The specification does not guarantee the accuracy of the parameters that are not given the upper and lower limit values, but the typical values reflect the performance of the device.

Note 5: The minimum and maximum parameter range of the datasheet is guaranteed by the test, and the typical value is guaranteed by design, test or statistical analysis.

Switch Characteristic

Unless otherwise stated, V_{DD}=5V, T_A=25°C.

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
f_{PWM}	OUT R/G/B/W output PWM frequency	I_{OUT}=18mA, OUT R/G/B/W series connects 200Ω resistor to VDD	-	4K	-	Hz
t_r	OUT R/G/B/W transfer time (Note 8)	I_{OUT}=16mA，OUT R/G/B/W connects 100Ω resistor to VDD, loads 15pF capacitor to ground	-	100	-	ns
t_f			-	170	-	ns

Note 6 shown as below.

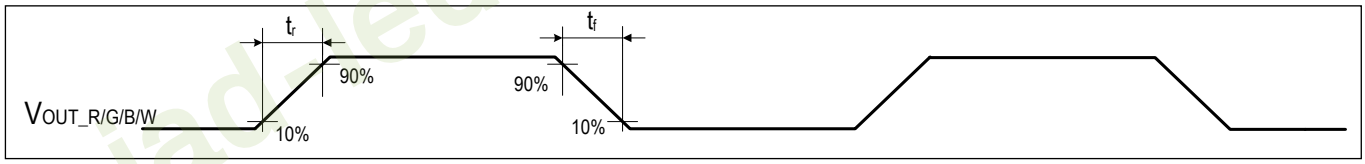


Fig. SM18512PS dynamic parameter test diagram

Data Communication Protocol

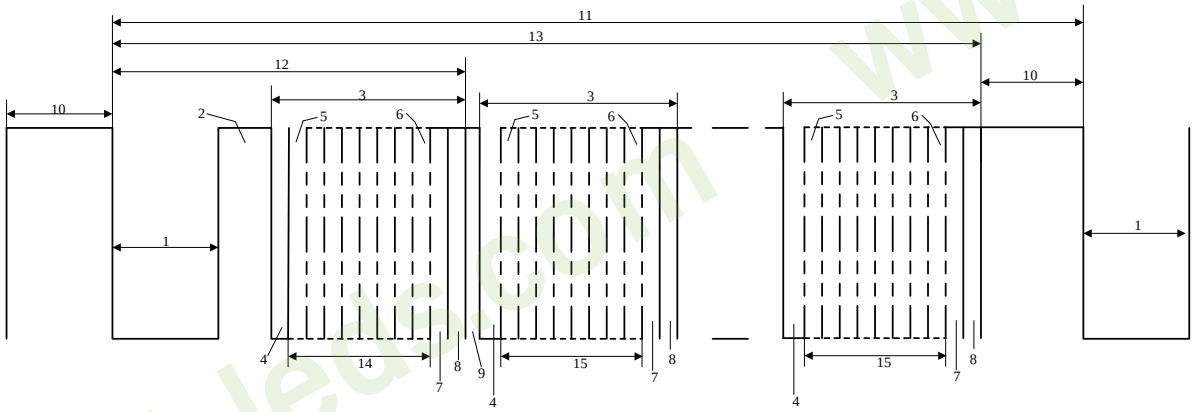


Fig. DMX512(1990) Data Communication Protocol Diagram

Figuer Key

1- "SPACE" for BREAK
2- "MARK" After BREAK (MAB)
3- Slot Time
4- START Bit
5- LEAST SIGNIFICANT Data BIT
6- MOST SIGNIFICANT Data BIT
7- STOP Bit
8- STOP Bit
9- "MARK" Time Between slots
10- "MARK" Before BREAK (MBB)
11- BREAK to BREAK Time
12- RESET Sequence (BREAK,MAB,START Code)
13- DMX512 Packet
14- START CODE (Slot 0 Data)
15- SLOT 1 DATA
16- SLOT nnn DATA (Maximun 512)

Designation	Description	Min	Typical	Max	Unit
-	Bit Rate	245	250	255	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	-	-	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	-	-	us
13	DMX512 Packet	1196	-	-	us

Note:

(1) The above data format is completely compatible with DMX512(1990).

(2) This product needs to receive at least two frames of data before refreshing the port output. The corresponding port output of the currently received data needs to be refreshed after identifying the next frame of data MAB.

Constant Current Characteristic

When it gets to constant current knee point, the SM18512PS output current is not affected by OUT voltage(V_{DS}). relationship between I_{OUT} and V_{DS} is shown below.

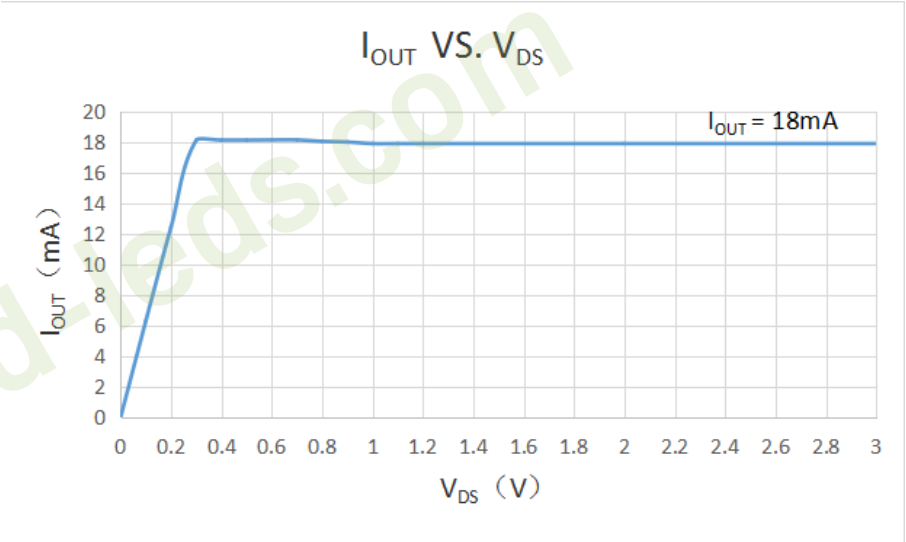


Fig. Relationship diagram between I_{OUT} and V_{DS}

Current Gain

The OUT RGBW of SM18512PS has 5bits current gain adjustment bit. The corresponding relationship between the output current value and the current gain bit is shown in the table below. D5~D1 ranged from high to low.

Current gain	D5	D4	D3	D2	D1	Corresponding current value（mA）
0	0	0	0	0	0	1.1
1	0	0	0	0	1	1.7
2	0	0	0	1	0	2.2
3	0	0	0	1	1	2.7
4	0	0	1	0	0	3.3
5	0	0	1	0	1	3.9
6	0	0	1	1	0	4.4
7	0	0	1	1	1	4.9
8	0	1	0	0	0	5.5
9	0	1	0	0	1	6.1
10	0	1	0	1	0	6.6
11	0	1	0	1	1	7.1
12	0	1	1	0	0	7.7
13	0	1	1	0	1	8.2
14	0	1	1	1	0	8.8
15	0	1	1	1	1	9.3
16	1	0	0	0	0	9.9
17	1	0	0	0	1	10.4
18	1	0	0	1	0	10.9
19	1	0	0	1	1	11.5
20	1	0	1	0	0	12.0
21	1	0	1	0	1	12.6
22	1	0	1	1	0	13.1
23	1	0	1	1	1	13.6
24	1	1	0	0	0	14.2
25	1	1	0	0	1	14.8
26	1	1	0	1	0	15.3
27	1	1	0	1	1	15.8
28	1	1	1	0	0	16.4
29	1	1	1	0	1	16.9
30	1	1	1	1	0	17.5
31	1	1	1	1	1	18.0

Automatic function selection

Description of automatic address writing function

1) Turn on the automatic address writing function: first set the chip automatic address writing step through the parameter writing function, and then use the controller to enable the automatic address writing function. After the instruction is written successfully, the first light will be red, and the rest will be purple.

2) When the automatic address writing function is turned on, the automatic addressing operation will be performed every time the power is turned on again (the controller needs to send a normal gray-scale data signal), the first chip(that is, the ADRI is suspended) at the signal input terminal is judged to be the first address 1, and The chip is automatically addressed according to the setting step number, and the new address data will be automatically saved.

3) After the automatic address writing is successful, the first chip lights up in red, and the other chips lights up in green for 2 seconds.

Description of automatic addressing function

1) Turn on the automatic addressing function: first set the step by writing parameters, and then use the controller to enable the automatic addressing function. After the instruction is written successfully, the first light will be red, and the rest will be purple;

2) After the lamp is powered on and the automatic addressing succeeds, the chip lights up green for 2 seconds; at the same time, the chip automatically exits the automatic addressing mode.

Adaptive function description

1) Turn on the adaptive function: use the controller to enable the adaptive function, the first light will be red after the instruction is successfully written, and the rest will be purple;

2) After the lamp is powered on and auto-adapted successfully, the chip will turn on green for 2 seconds; at the same time, the chip will automatically exit the auto-adaptation mode.

Note of automatic function:

1. When the automatic function is selected through the controller, only one of the automatic addressing/automatic address writing/adaptive functions can be selected; after the selection is successful, the first light will be red and the other bright purple lights are signs;
2. Automatic addressing/self-application can be used for lamp repair. Lamps with automatic addressing function can be automatically identified when they are repaired; lamps with adaptive function turned on, and addresses, parameters and current gains can be automatically identified when they are repaired;
3. The headlight does not support automatic addressing/adaptive function;
4. After the controller writes the address, all automatic functions will be automatically closed;
5. After the project debugging is completed, it is recommended to turn off the automatic address writing function.

Address line open circuit self-check function

SM18512PS built-in address open circuit self-checking function is as follows:

1) Turn on the self-check function: turn on the self-check function through the parameter writing function;

2) After the self-check function is turned on, each time the power is turned on, the chip automatically detects whether it is connected to the previous-level lamp address line normally. If the line is open or the lamp is the first light, it will light up in red, and the normally connected lamp will not light up.

Note: The self-check function is not effective for chips with automatic function.

OUT port opening width compensation

SM18512PS opening width compensation function as follows:

1) Turn on the self-check function: turn on the width compensation function through the parameter writing function;

2) OUT port opening width compensation is level 0~6, each level increases the OUT port opening time by about 260ns, level 0 means no compensation.

Typical Application

SM18512PS uses differential parallel transmission, it adopts the international DMX512 (1990) protocol, and supports the maximum number of channel up to 4095.

In the engineering application, the controller does not need to connect four wires to the first lamp point, only need to connect the A/B differential signal line and ground wire to complete the operation of writing address and display control, which improves the flexibility of engineering installation.

1、 SM18512PS RGBW Typical Combination Application Circuit

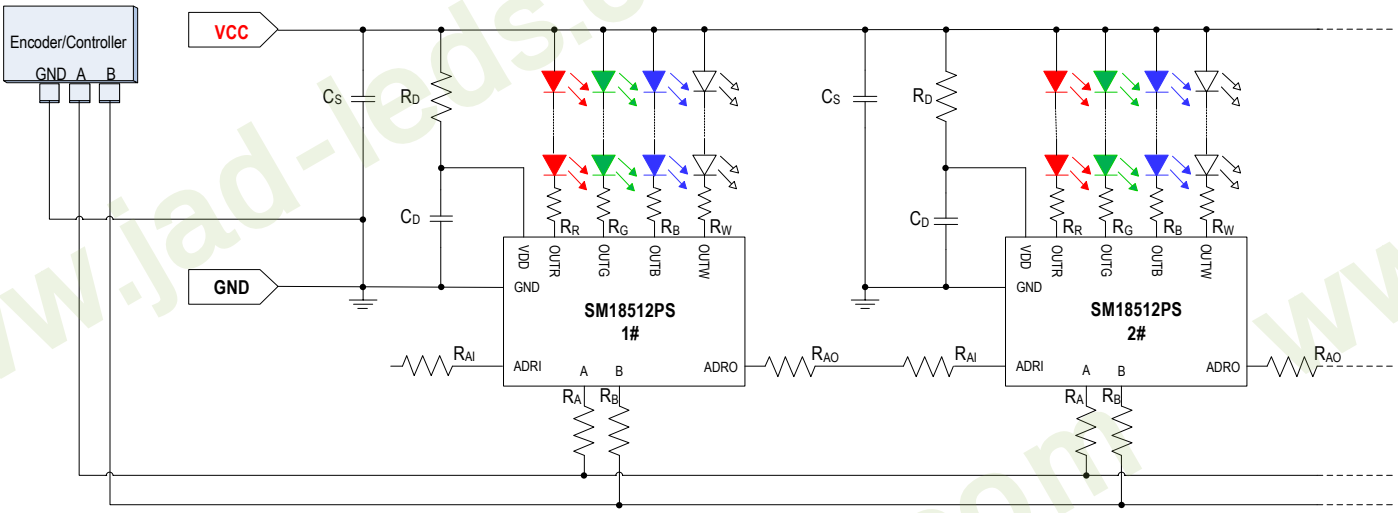


Fig. SM18512PS Typical application diagram

The typical application circuit of SM18512PS includes VCC (input voltage of power supply), R_D (current-limit resistor) ,C_S (system power filtering capacitor), and R_R, R_G, R_B, R_W (divider resistor of R/G/B/W LED), R_{AI}(address signal input protection resistor), R_{AO} (address signal output protection resistor) and R_A, R_B (A/B bus signal cascaded resistor).

(1)VCC is external input voltage, RD is current-limit resistor for limiting the internal voltage-stabilizing operation current when turns on the chip voltage-stabilizing function. Chip operation voltage: V_{DD}: V_{DD}=VCC-(I_{DD}+I_{IN})*R_D

I_{IN} is the internal voltage-stabilizing operation current, I_{DD} is the chip quiescent current, the value of R_D must keep V_{DD}>3V. The higher the R_D is, the lower the system power consumption is, and the anti-interference capability is weak; the lower the R_D is, the higher the system power consumption is, and the operating temperature is higher, therefore the R_D should be selected compromisingly based on the system application environment in the design. The relation between VCC and R_D is given by:

VCC（V）	5V	6V	9V	12V	15V	18V	24V	36V
R_D（Ω）	33	68	300	1.0K	1.5K	2.0K	3.0K	2.4K+2.4K

(2)Cs is system power capacitance to the ground for reducing the power fluctuations, select 0.1uF-10uF according to actual load situation.

(3)C_D is chip filter capacitor for keeping VDD voltage stable and guarantee normal operation. Recommend to choose 100nF.

(4)R_A and R_B are A/B signal input protection resistor, prevent A, B port from damage that makes bus data abnormal.

(5)R_{AI} is address signal input protection resistor for preventing electric plug, positive and negative pole and signal wire in reverse which would damage the signal input port.

(6)R_{AO} is address signal output protection resistor for preventing electric plug, positive and negative pole and signal wire in reverse

which would damage the signal output port.

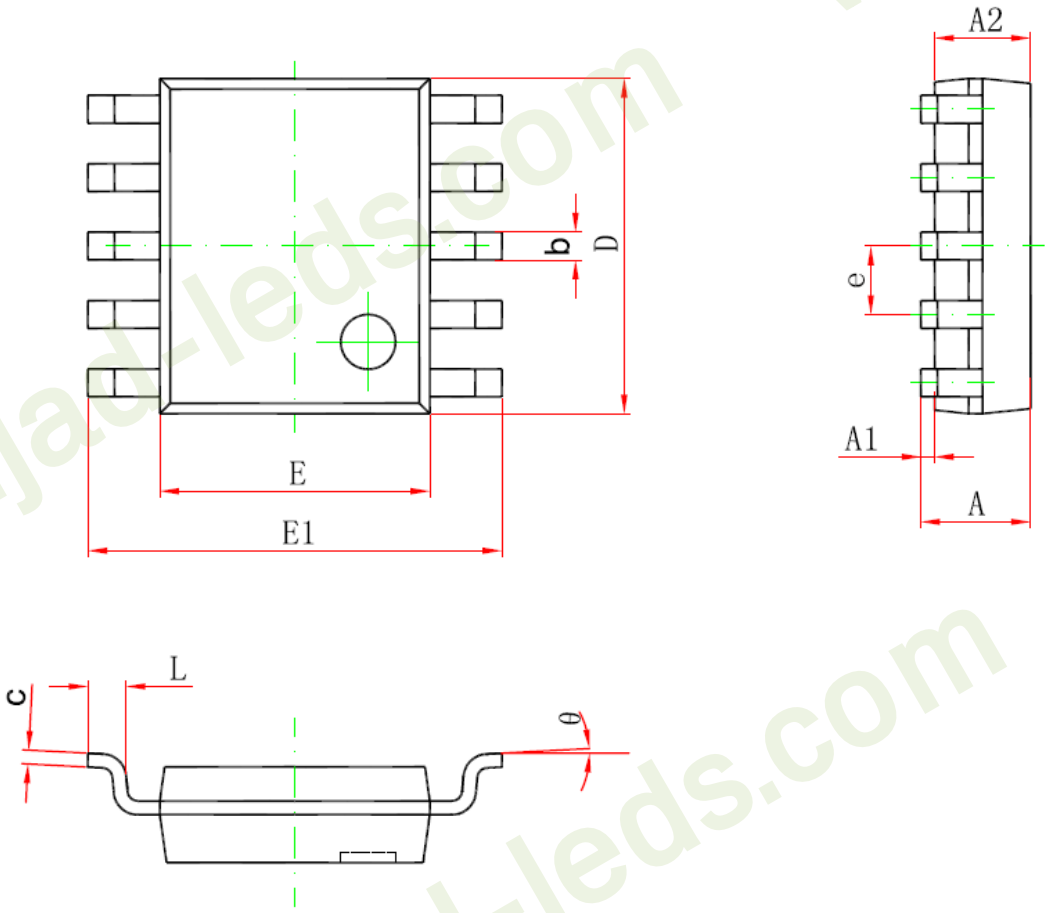
(7)R_R, R_G, R_B, R_W is divider resistor for OUTR/G/B/W for reducing the OUTR/G/B/W voltage and the power consumption. The value is given by: $R_R/R_G/R_B/R_W=(VCC-N*V_{LED}-V_{DS})/I_{LED}$, VCC is input voltage, V_{LED} is LED conduction voltage drop, I_{LED} is output current, V_{DS} is OUTR/G/B/W voltage which is constant output on 1V. Consider voltage loss in actual application, OUTR/G/B/W voltage should be considered to guarantee constant current output. Recommend to design OUTR/G/B/W voltage (V_{DS}) as 3.0V. Concrete will be subject to actual application. Different LED color pressure drop, reference as follows. Red: 2.2V, green, blue and white: 3.2V, concrete will be subject to actual specification.

In typical application, according to different input voltage, different number of beads, the parameters of corresponding recommended values as follow:

Voltage VCC	LED cascaded in OUTR/G/B/W (piece)	R_D(Ω)	C_D（nF）	R_A(Ω)	R_B(Ω)	R_{AI}(Ω)	R_{AO}(Ω)	R_R(Ω)	R_G(Ω)	R_B(Ω)	R_W(Ω)
12V	3	1K	100	10K	10K	510	510	150	-	-	-
24V	6	3K	100	10K	10K	510	510	510	150	150	150

Package

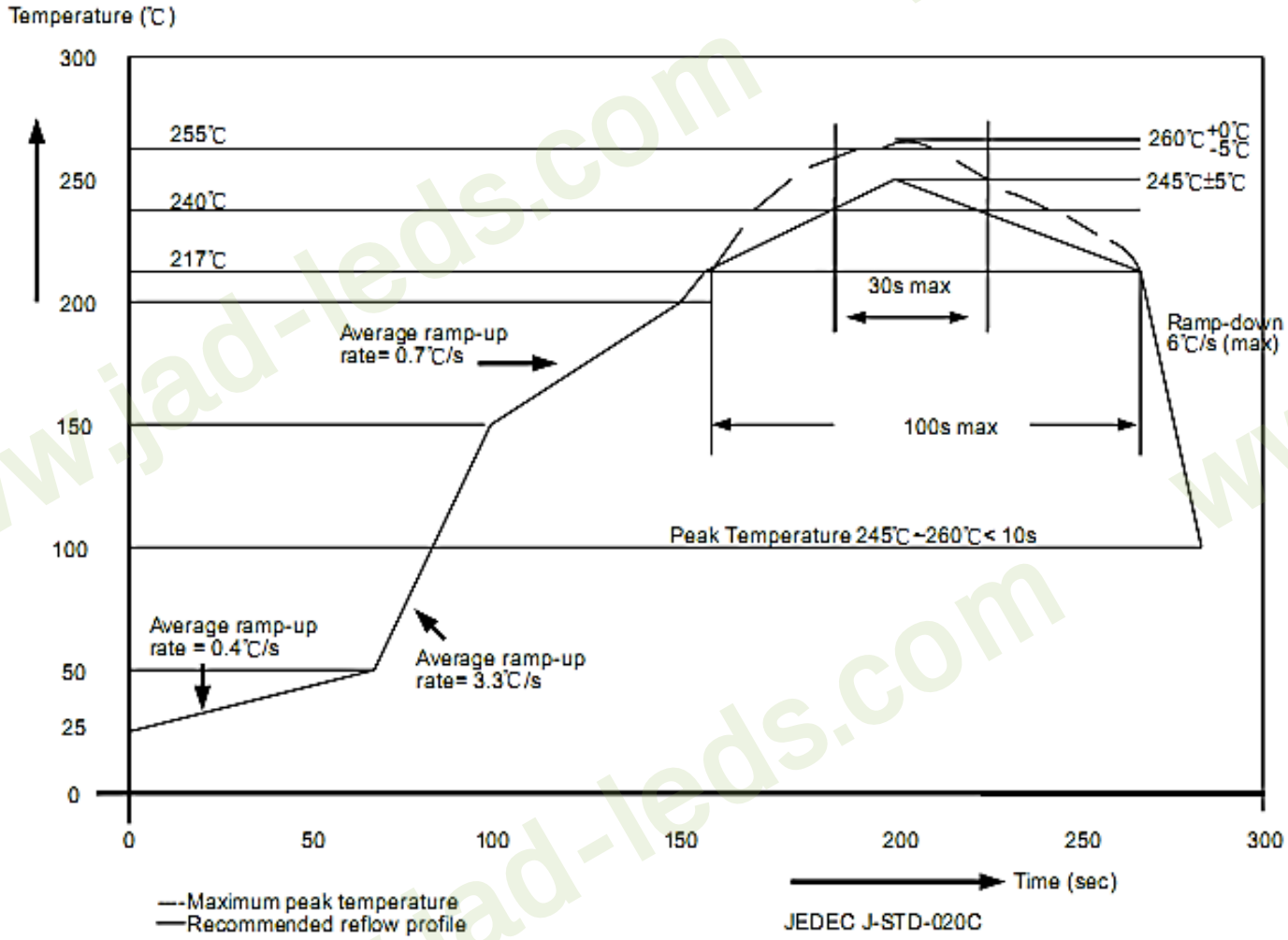
SSOP10



Symbol	Millimenters		Inchs	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.300	0.450	0.012	0.018
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.201
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.000(BSC)		0.039(BSC)	
L	0.400	1.270	0.016	0.050
θ	0^0	8^0	1^0	8^0

Encapsulation Soldering Process

Semiconductors of Sunmoon follow the European RoHs standard, solder temperature in encapsulation soldering process follows J-STD-020 standard.



Encapsulation Thickness	Volume mm^3 < 350	Volume mm^3：350~2000	Volume mm^3 ≥ 2000
<1.6mm	260+0°C	260+0°C	260+0°C
1.6mm~2.5mm	260+0°C	250+0°C	245+0°C
≥2.5mm	250+0°C	245+0°C	245+0°C

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