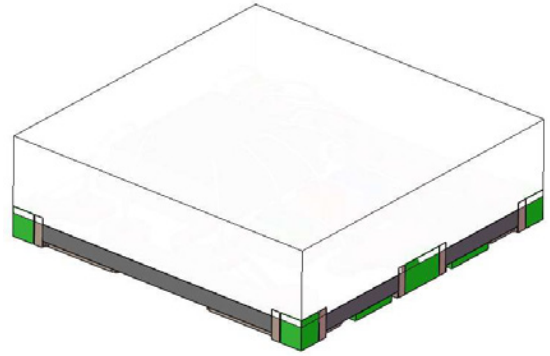


1.产品概述 Product overview:

- 工作电压：5V@18mA可调(OUT RGB) ;
Forward voltage: 5V@18mA Adjustable (OUT RGB) ;
- 发光角度：160°;
Luminescent angle: 160 ° ;
- 胶体颜色：半透明;
Lens color: translucent ;
- 内置复位电路，上电不亮灯;
Built-in reset circuit, power does not light ;
- 灰度调节：256级，电流增益：5Bit(32级) ;
Grayscale adjustment: 256 levels , current gain: 5Bit (level 32);
- SPI 传输协议，双线数据传输，可无限级联;
SPI transmission protocol, dual line data transmission, infinite cascading capability;
- 最大串行输入数据频率15MHZ;
Maximum serial input data frequency 15MHz;
- 湿敏等级：4;
MSL: 4;
- 静电ESD：2KV;
ESD level: 2KV;
- 符合RoHS REACH;
RoHS and REACH-compliant;



2.主要应用 Main applications:

- 消费电子产品
Consumer electronics

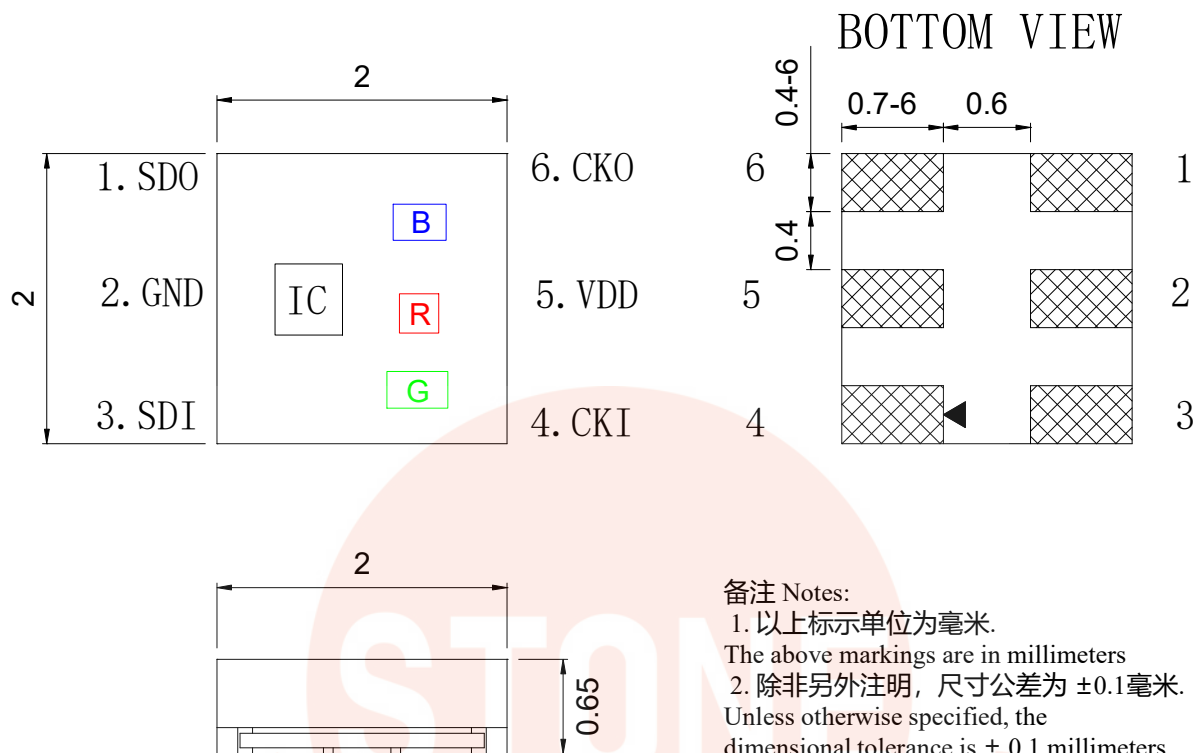
3. 产品命名一般说明 General instructions for product naming:

YS-IC2020RGB18-P6

① ② ③ ④

①	②	③	④
系列 Series	封装外形 Package outline	颜色代码 Color and current codes	引脚数量 Number of pins
双线低灰传输 IC Dual wire low gray transmission IC	2.0x2.0x0.65毫米 PCB支架 封装 2.0x2.0x0.65mm PCB holder package	R/G/B: 18mA电流版本 R/G/B: 18mA current	P6: 6PINS

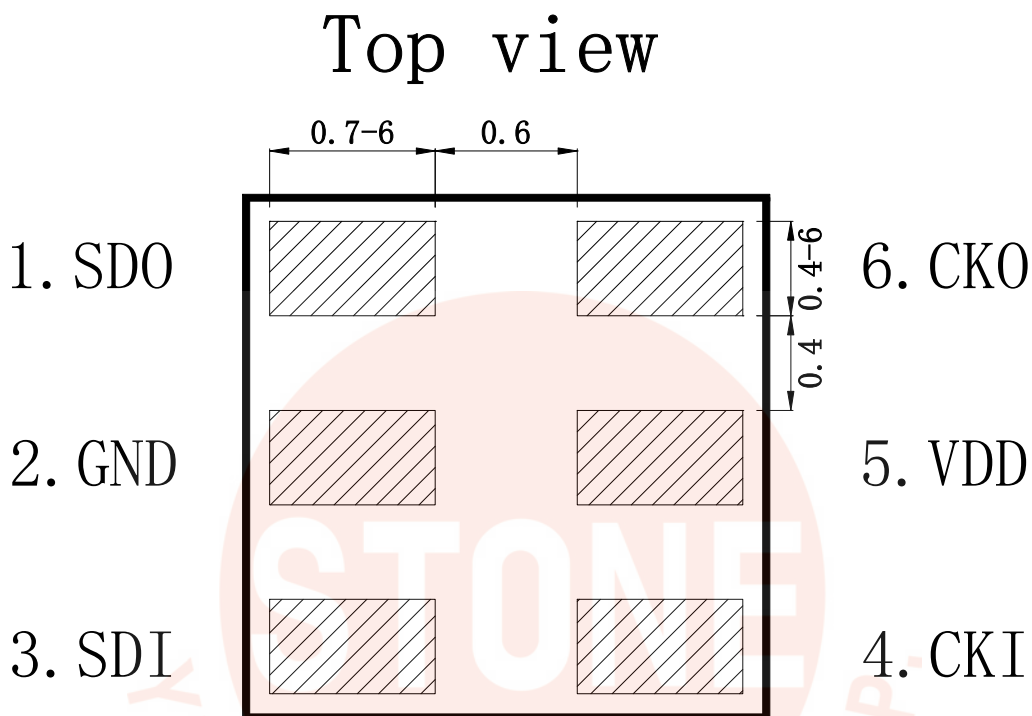
4.机械尺寸 Mechanical dimensions:



5. 引脚功能说明 Pin Function Description:

序号 Serial Number	符号 Symbol	管脚名 Pin name	功能描述 Function Description
1	SDO	数据输出 Data output	串接资料输出端 Serial data output terminal
2	GND	地或电源负端 Ground or power negative terminal	电源负极 Negative pole of power supply
3	SDI	数据输入 Data input	串接资料输入端 Serial data input terminal
4	CKI	时钟输入 Clock input	串接时钟信号输入端 Serial connection of clock signal input terminal
5	VDD	供电电源正端 Positive end of power supply	电源正极 Positive pole of power supply
6	CKO	时钟输出 Clock output	串接时钟信号输出端 Serial connection of clock signal output terminal

6. PCB建议焊盘尺寸 PCB recommended pad size:



7. IC极限参数 IC limit parameter : (Ta=25°C)

参数 Parameter	符号 Symbol	范围 Range	单位 Unit
逻辑电源电压 Working voltage	V_{DD}	$-0.3 \sim V_{DD} + 0.3$	V
工作温度 Operation temperature	T_{opt}	$-40 \sim +85$	°C
储存温度 Storage temperature	T_{stg}	$-40 \sim +85$	°C
ESD耐压 (人体模式) ESD withstand voltage (human mode)	V_{ESD}	2K	V

8. RGB LED 光电参数 Optoelectronic parameters:

颜色 Colour	YS-IC2020RGB18-P6 18mA	
	波长 (nm) Wavelength (nm)	亮度 (mcd) Brightness (mcd)
红色 (RED)	620-625	160-320
蓝色 (BLUE)	465-470	80-160
绿色 (GREEN)	525-530	320-580

9. IC电气参数 IC electrical parameters: (TA=25°C)

参数 Parameter	符号 Symbol	最小 Minimum	典型 Typical	最大 Maximum	单位 Unit	测试条件 Test conditions
工作电压 Chip input voltage	VDD	---	5	5.3	V	---
信号输入翻转阈值 Signal input flip threshold	VIH	3.4	---	5.3	V	---
	VIL	-0.3	---	1.6	V	---
R/B/G输出驱动电流 R/B/G output drive current	I _{DOUT}	16	---	21	mA	V _{DS} =1V
PWM频率 PWM frequency	F _{PWM}	---	1.2	---	KHz	---
静态功耗 Static power consumption	I _{DD}	---	1	---	mA	---

10. 功能说明 Function Description:

(1) 串接资料结构 Serial data structure

0*32	LED 1	LED 2	LED 4		LED N	1*32
起始帧 Start frame	数据帧 Data frame	数据帧 Data frame	数据帧 Data frame		数据帧 Data frame	结束帧 End frame
起始帧 Start frame	0000 0000	0000 0000	0000 0000	0000 0000	0000 0000	
数据帧 Data frame	3位帧头 111 3-bit Identify data bits 111	5位亮度调整 5-bit brightness adjustment	8位红灯数据 8-bit red light data	8位蓝灯数据 8-bit blue light data	8位绿灯数据 8-bit green light data	
		高位在前 MSB first	高位在前 MSB first	高位在前 MSB first	高位在前 MSB first	
结束帧 End frame	1111 1111	1111 1111	1111 1111	1111 1111	1111 1111	

产品输出结构：RGB顺序点亮，优化产品混色效果（调整IC默认RGB顺序晶片位置）；

Product output structure: RGB sequential lighting, optimizing product color mixing effect (adjusting IC default RGB sequential chip position);

(2) 刷新率 Refresh rate

帧频 = $1 / ((64 + (32 * \text{点数})) * \text{CKI 周期})$ (单位: 帧/秒)

Frame rate = $1 / (64 + (32 * \text{points})) * \text{CKI cycle}$ (unit: frames/second)

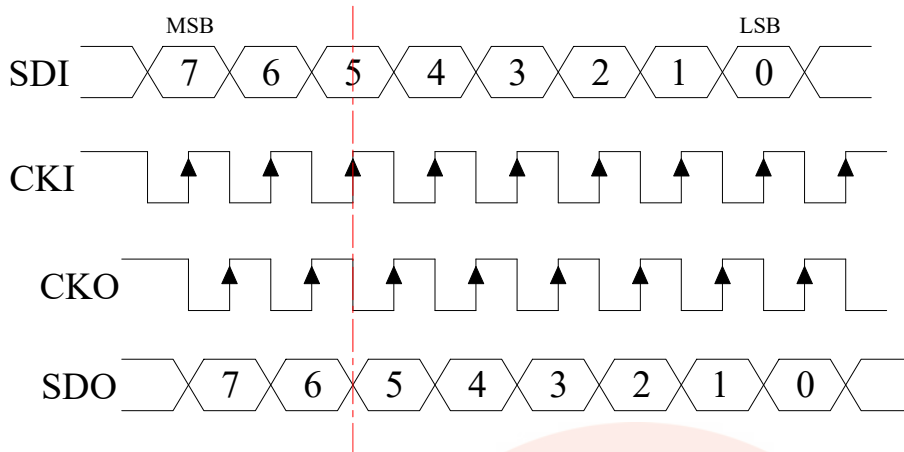
如：1024 个点，CKI 频率为 1MHZ，则 帧频=30 帧/秒

For example, if there are 1024 points and the CKI frequency is 1MHz, the frame rate is 30 frames per second

(3) 256级灰度 256 level grayscale

数值 Numerical value	占空比 Duty cycle
MSB.....LSB	
0000 0000	0/256
0000 0001	1/256
0000 0010	2/256
-	-
-	-
-	-
1111 1101	253/256
1111 1110	254/256
1111 1111	255/256

(4) PWM输入输出信号关系 PWM input-output signal relationship:



SDI 在CKI 下降沿跳变，在CKI 上升沿读入当前芯片。

SDI jumps on the falling edge of CKI and reads the current chip on the rising edge of CKI.

SDO 在CKI 上升沿跳变，在CKI 的下降沿读入下一颗芯片。

SDO jumps on the rising edge of CKI and reads the next chip on the falling edge of CKI.

也就是：

输入数据SDI 在CKI 的下降沿开始跳变，跳变稳定后，在CKI 的上升沿才能被读入；

输出数据SDO 要在输入数据SDI 被读入后才能输出，而SDI 是在CKI 上升沿被读入的，所以SDO 是在CKI 的上升沿输出。

That is to say: The input data SDI starts to jump at the falling edge of CKI, and only after the jump stabilizes can it be read at the rising edge of CKI; The output data SDO can only be output after the input data SDI is read in, and SDI is read in on the rising edge of CKI, so SDO is output on the rising edge of CKI.

CKI 上升沿时刻：

是读入本级芯片SDI，同时输出本级的SDO，就是下一级芯片的输入数据SDInext 的时刻，如果CKI 和CKO 同步，信号完全一样，那么就出现在CKI 上升沿这一刻，所有芯片同时输入数据和输出数据！这是极不稳定的状况，数据传输会全部乱套。

CKI rising edge time: It is the moment when the SDI of the current level chip is read in and the SDO of the current level is output, which is the input data SDInext of the next level chip. If the CKI and CKO are synchronized and the signal is exactly the same, then it occurs at the rising edge of the CKI, and all chips input and output data simultaneously! This is an extremely unstable situation, and data transmission will be completely chaotic.

所以，CKI 和CKO 的波形要错开；同时需要错开系统间存在的时延问题，统一设计CKO比CKI减少半个Clock.

So, the waveforms of CKI and CKO should be staggered; At the same time, it is necessary to stagger the latency issues between systems and design a unified CKO that reduces CKI by half a Clock

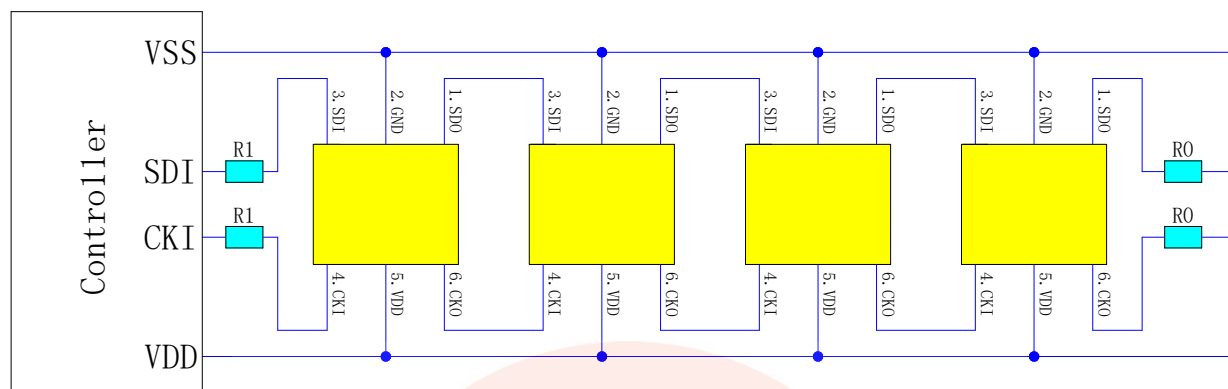
产品输出结构：GRB顺序点亮，优化产品混色效果（调整IC默认RGB顺序晶片位置）；

Product output structure: GRB sequential lighting, optimizing product color mixing effect (adjusting IC default RGB sequential chip position);

(5) 5-Bit(32级) 亮度调整 (同时控制OUTR\OUTB\OUTG三个端口的电流 5-Bit (level 32) brightness adjustment (simultaneously controlling the current of the three ports OUTR, OUTB, and OUTG)):

电流调节等级 Current regulation level	数值(MSB.....LSB) numerical value	电流调整 Current adjustment	对应电流值 (mA) Corresponding current value	备注 Notes
1	00000	0/31	0	建议使用电流: 1~10 电流调节等级 Suggested use of current: 1-10 current regulation level
2	00001	1/31	0.581	
3	00010	2/31	1.162	
4	00011	3/31	1.743	
5	00100	4/31	2.324	
6	00101	5/31	2.905	
7	00110	6/31	3.486	
8	00111	7/31	4.067	
9	01000	8/31	4.648	
*10	01001	9/31	5.229	
11	01010	10/31	5.81	基于产品散热, 此款 产品电流建议最大使用: 0-5mA调节使用, 电流调节等级11~32级 不建议使用 Based on the heat dissipation of the product, it is recommended to use a maximum current of 0- 5mA for adjustment. The current adjustment level of 11-32 is not recommended
12	01011	11/31	6.391	
13	01100	12/31	6.972	
14	01101	13/31	7.553	
15	01110	14/31	8.134	
16	01111	15/31	8.715	
17	10000	16/31	9.296	
18	10001	17/31	9.877	
19	10010	18/31	10.458	
20	10011	19/31	11.039	
21	10100	20/31	11.62	
22	10101	21/31	12.201	
23	10110	22/31	12.782	
24	10111	23/31	13.363	
25	11000	24/31	13.944	
26	11001	25/31	14.525	
27	11010	26/31	15.106	
28	11011	27/31	15.687	
29	11100	28/31	16.268	
30	11101	29/31	16.849	
31	11110	30/31	17.43	
32	11111	31/31	18	

11.应用电路原理图 Principles of Applied Circuits:



在实际应用电路中，为防止产品在测试时带电插拔产生的瞬间高压损伤IC内部电源及信号输入输出脚，应在信号输入及输出端串接保护电阻。此外，为了使各IC芯片间更稳定工作，各灯珠间的退偶电容则必不可少；

1. 产品两端所并的退偶电容一般不建议省略；

2. 产品的信号输入及输出端必需串接保护电阻R1/R2，因线材及传输距离不同，在两端串接的保护电阻会略有不同；R1/R2的大小取决于级联灯珠的数量，级联数量越多，则R1/R2越小，灯珠间传输距离长，一般建议在20-2K Ω 之间取值，通常建议取值在500欧左右；以实际使用情况定；

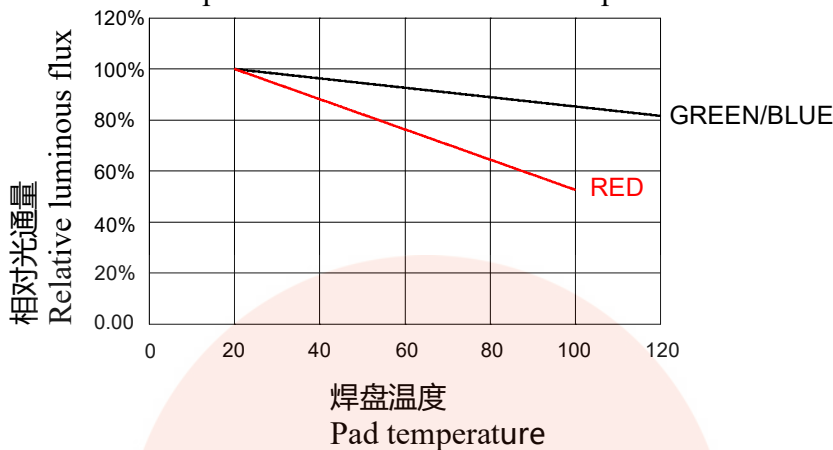
In practical application circuits, to prevent instantaneous high voltage damage to the internal power supply and signal input/output pins of the IC caused by live plugging and unplugging during testing, protective resistors should be connected in series at the signal input and output terminals. In addition, in order to ensure more stable operation between IC chips, the decoupling capacitance between each LED is essential;

1. It is generally not recommended to omit the decoupling capacitance at both ends of the product;

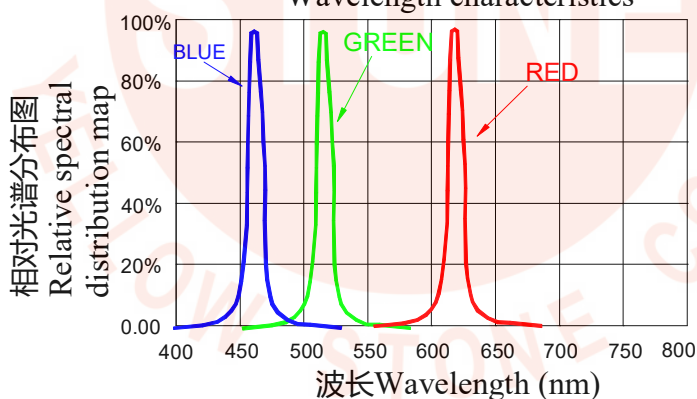
2. The signal input and output terminals of the product must be connected in series with protective resistors R1/R2. Due to different wire materials and transmission distances, the protective resistors connected in series at both ends may vary slightly; The size of R1/R2 depends on the number of cascaded light beads. The more cascaded the number, the smaller the R1/R2, and the longer the transmission distance between the light beads. It is generally recommended to take a value between 20-2K Ω , and it is usually recommended to take a value of around 500 Ω ; Based on actual usage;

12. 光电特性 Photoelectric characteristic:

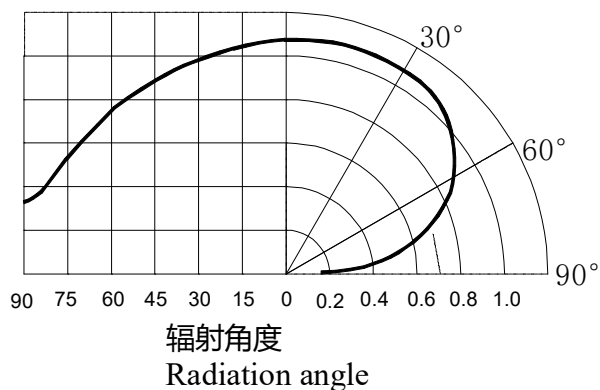
焊盘温度与光通量输出的相对关系
 The relative relationship between pad temperature and luminous flux output



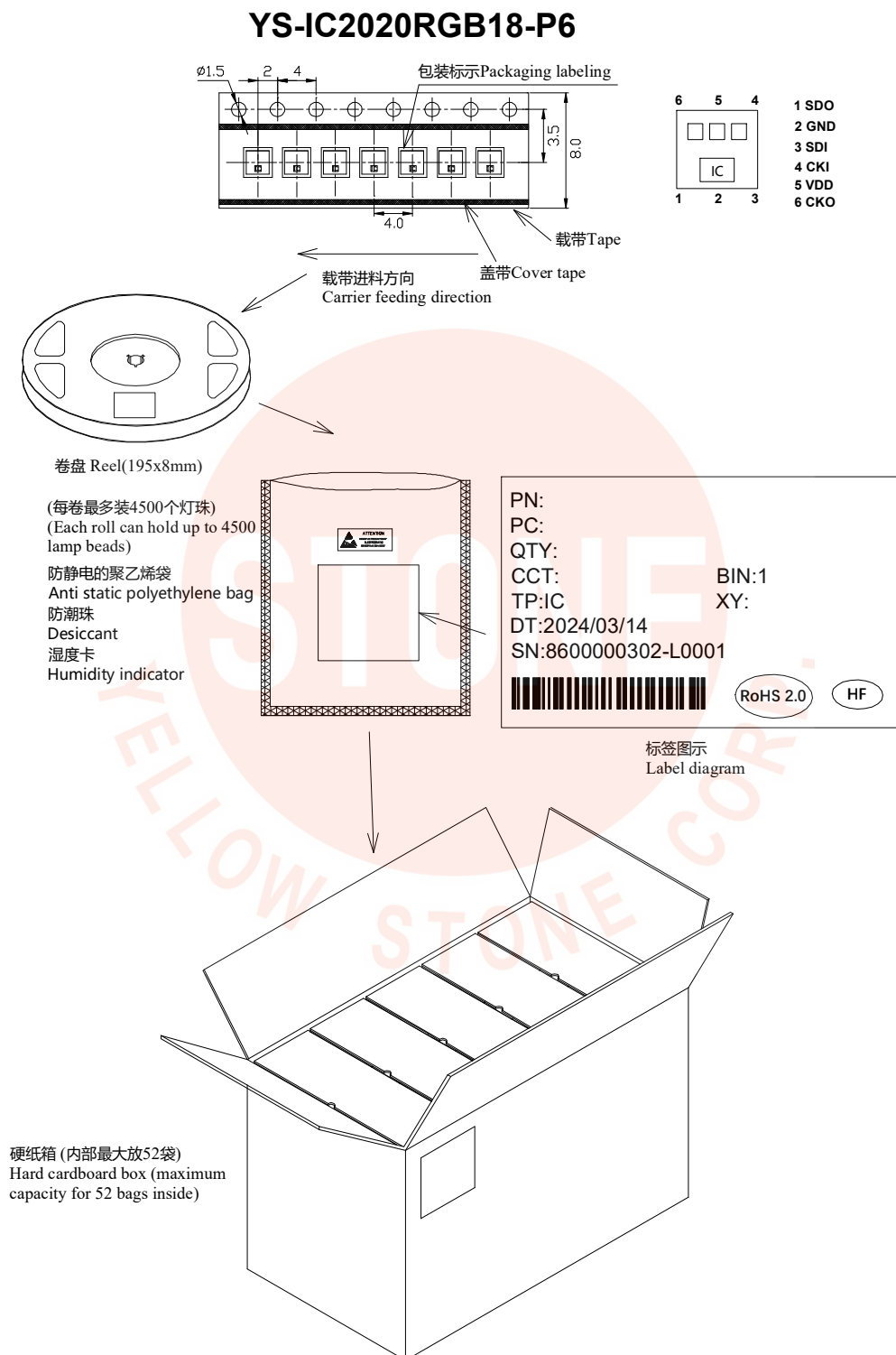
波长特性
 Wavelength characteristics



典型的辐射方向图 160°
 Typical radiation pattern 160°



13. 包装标准 Packaging standards:



表面贴装LED采用卷盘包装，LED在用普通或防静电袋包装后再装在纸箱中。纸箱用于保护运输途中LED不受机械冲击，纸箱不防水，因此请注意防潮防水。

Surface mounted LEDs are packaged in rolls, and the LEDs are packaged in regular or anti-static bags before being packed in cardboard boxes. The cardboard box is used to protect the LED from mechanical impact during transportation. The cardboard box is not waterproof, so please pay attention to moisture-proof and waterproof.

14. 可靠性测试 Reliability testing:

序号 Serial Number	实验项目 Pilot projects	实验条件 Experimental condition	参考标准 Reference standards	判断 Determine
1	冷热冲击 Thermal Shock	$100 \pm 5^{\circ}\text{C} \sim -40^{\circ}\text{C} \pm 5^{\circ}\text{C}$ 15min~15min 100cycles	MIL-STD-202G	0/22
2	高温储藏 High temperature storage	Ta= +100°C 1000hrs	JEITA ED-4701 200 201	0/22
3	低温储藏 Low temperature storage	Ta= -40°C 1000hrs	JEITA ED-4701 200 202	0/22
4	高温高湿储藏 High temperature and high humidity storage	Ta=60°C RH=90% 1000hrs	JEITA ED-4701 100 103	0/22
5	温度循环 Temperature cycling	-40°C~25°C~100°C~25°C 30min~5min~30min~5min 100 cycles	JEITA ED-4701 100 105	0/22
6	耐焊接热 Resistance to Soldering Heat	Tsld = 260°C, 10sec. 2 times	JEITA ED-4701 300 301	0/22
7	常温寿命测试 Normal temperature life test	25°C, IF: Typical current , 1000hrs	JESD22-A 108D	0/22

失效判定标准 Failure criteria:

项目 Project	符号 Symbol	测试条件 Test conditions	判断标准 Judgment criteria	
			最小值 Minimum value	最大值 Maximum value
发光强度 Intensity	IV	DC=5V,规格典型电流 DC=5V, typical current specification	初始数据X0.7 Initial data X0.7	---
耐焊接热 Resistance to Soldering Heat	---	DC=5V,规格典型电流 DC=5V, typical current specification	无死灯或明显损坏 No dead lights or obvious damage	