



# 规格书

## SPECIFICATION

产品名称 Description: 5V4脚4020(4.0\*2.0\*1.6)幻彩led

产品型号 Model : ZH4020L4-1812MD-A03

客户代码 Customer NO:

制作日期 Date: 2022, 02, 15

制造编码 Date: ZH-AFNL-9001

制作 Prepared By	审核 Checked By	市场部 Marketing Dept
客户确认 APPROVED SIGNATURES		
核准 Approval	审核 Examine.	承认 Admit





## 主要特点

(Main features)

- IC 控制电路与 LED 点光源共用一个电源。  
The IC control circuit and the LED point light source share one power supply.
- 控制电路与 RGB 芯片集成在一个 4020 封装的元器件中，构成一个完整的外控像素点。  
The control circuit and the RGB chip are integrated in a 4020 packaged component, constituting a complete externally controlled pixel point.
- 内置信号整形电路，任何一个像素点收到信号后经过波形整形再输出，保证线路波形畸变不会累加。  
Built-in signal shaping circuit. After any pixel point receives the signal, it is output after waveform shaping to ensure that the waveform distortion of the line will not accumulate.
- 内置上电复位和掉电复位电路。  
Built-in power-on reset and power-down reset circuits
- 每个像素点的三基色颜色可实现 256 级亮度显示，完成 16777216 种颜色的全真色彩显示。  
The three primary colors of each pixel point can achieve 256-level brightness display, and complete the true-color display of 16,777,216 kinds of colors.
- 端口扫描频率 2KHz。  
The port scanning frequency is 2 KHz
- 串行级联接口，能通过一根信号线完成数据的接收与解码。  
Serial cascade interface, which can complete the reception and decoding of data through a single signal line.
- 任意两点传输距离在不超过 5 米时无需增加任何电路。  
When the transmission distance between any two points does not exceed 5 meters, there is no need to add any circuit.
- 当刷新速率 30 帧/秒时，级联数不小于 1024 点。  
When the refresh rate is 30 frames per second, the cascade number is not less than 1024 points.
- 数据发送速度可达 800Kbps。  
The data transmission speed can reach up to 800 Kbps.
- 光的颜色高度一致，性价比高。  
The color of the light is highly consistent and has high cost performance

## 主要应用领域

(Main application fields)

- LED 全彩发光字灯串，LED 全彩软灯条硬灯条，LED 护栏管。  
LED full-color luminous word light string, LED full-color flexible light strip and hard light strip, LED guardrail tube.
- LED 点光源，LED 像素屏，LED 异形屏，各种电子产品，电器设备跑马灯。  
LED point light source, LED pixel screen, LED special-shaped screen, various electronic products, marquee lights of electrical equipment.

## 产品概述

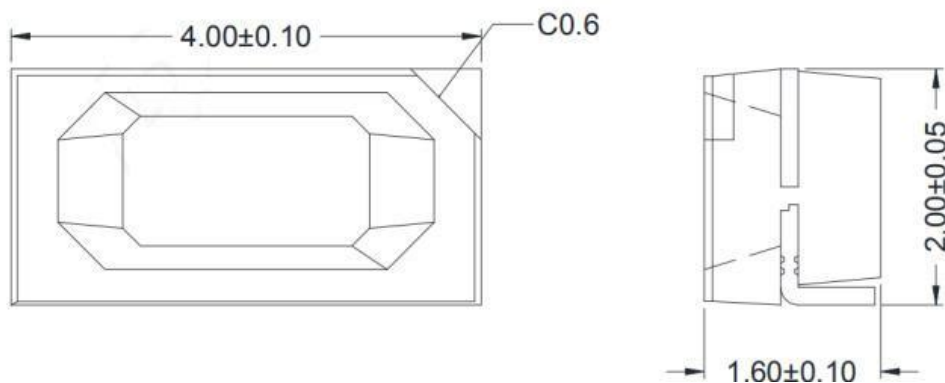


## (Product overview.)

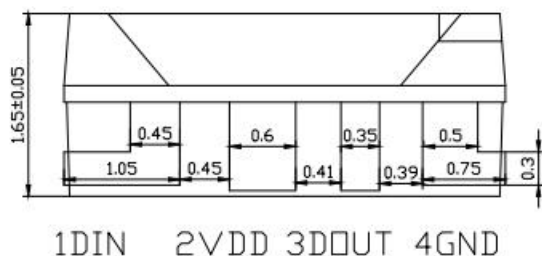
ZH4020L4-1812MD-A03是一个集控制电路与发光电路于一体的智能外控 LED 光源。具有较小体积，其外型尺寸与一个 4020LED 灯珠相同，每个元件即为一个像素点。像素点内部包含了智能数字接口数据锁存信号整形放大驱动电路，还包含有高精度的内部振荡器和可编程定电流控制部分，有效保证了像素点光的颜色高度一致。

ZH4020L4-1812MD-A03is an intelligent external-controlled LED light source that integrates the control circuit and the light-emitting circuit. It has a relatively small volume, and its external dimension is the same as that of a 4020LED lamp bead, and each element is a pixel point. The pixel point contains an intelligent digital interface data latch signal shaping amplification driving circuit, and also includes a high-precision internal oscillator and a programmable constant current control part, which effectively ensures a high degree of consistency in the color of the light of the pixel point.

## 机械尺寸（单位mm）

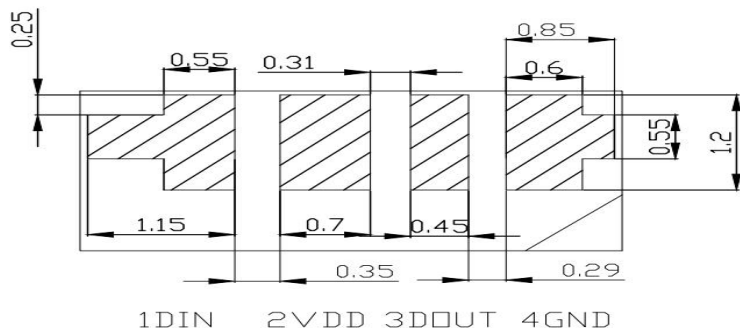


(Mechanical dimension (unit: mm).





(Recommended size of the solder pad)



序号 Serial number	符号 sign	管脚名 Pin name	功 能 描 述 Function Description
1	DIN	数据输入	控制数据信号输入（Control data signal input）
2	VDD	电源	供电管脚（Power supply）
3	DOU T	数据输出	控制数据信号输出（Control data signal output）
4	GND	地	信号接地和电源接地（Signal grounding and power supply grounding）

## (Maximum Rated Value (Unless otherwise specified, TA = 25° C, VSS = 0V))

参数argument	符号sign	范围extent	单位unit
电源电压Power supply voltage	V <sub>DD</sub>	+3.5~+5.5	V
逻辑输入电压 Logic input voltage	V <sub>I</sub>	-0.5~ V <sub>DD</sub> +0.5	V
工作温度Working temperature	T <sub>opt</sub>	-40~ +85	℃
储存温度Storage temperature	T <sub>stg</sub>	-40~+105	℃
ESD耐压（设备模式） ESD withstand voltage (device mode)	V <sub>ESD</sub>	200	V
ESD耐压（人体模式）ESD withstand voltage (human body mode)	V <sub>ESD</sub>	5K	V



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电气参数 (如无特殊说明,  $T_A = -20 \sim +70^\circ\text{C}$ ,  $V_{DD} = 4.5 \sim 5.5\text{V}$ ,  $V_{SS} = 0\text{V}$ )

Electrical parameters (Unless otherwise specified,  $T_A = -20$  to  $+70^\circ\text{C}$ ,  $V_{DD} = 4.5$  to  $5.5\text{V}$ ,  $V_{SS} = 0\text{V}$ )

参数 parameter	符号 sign	最小min	典型 typical	最大 max	单位 unit	测试条件 Test conditions
芯片内部电源电压 Internal power supply voltage of the chip	VDD	---	5		V	---
R/G/B 端口耐压 Withstand voltage of R/G/B ports	VDS,MAX	---	---	9	V	---
DOUT 驱动能力 DOUT driving capability	IDOH	---	15	---	mA	DOUT 接地, 最大驱动 电流
	IDOL	---	30	---	mA	DOUT 接正, 最大灌电 流
信号输入翻转阈值Signal input inversion threshold	VIH	$0.7 \cdot V_{DD}$	$0.9 \cdot V_{DD}$	VDD	V	VDD=5.0V
	VIL	0	$0.1 \cdot V_{DD}$	$0.3 \cdot V_{DD}$	V	
PWM 频率 PWM frequency"	FPWM	---	4	---	KH Z	---
静态功耗 Static power consumption	IDD	---	0.65	---	mA	---



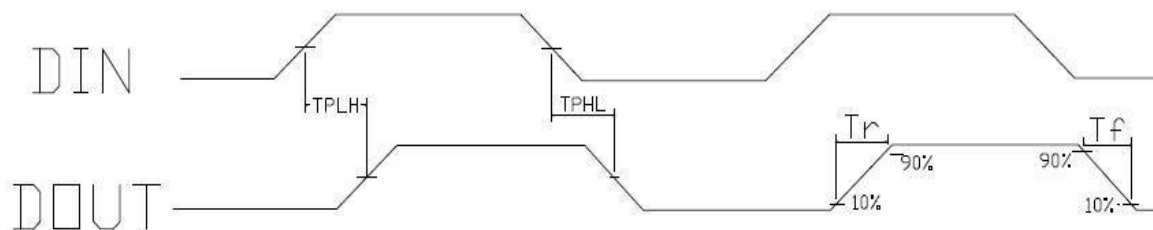
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开关特性（如无特殊说明， $T_A = -20 \sim +70^\circ\text{C}$ ， $V_{DD} = 4.5 \sim 5.5\text{V}$ ， $V_{SS} = 0\text{V}$ ）

(Switching characteristics (Unless otherwise specified,  $T_A = -20$  to  $+70^\circ\text{C}$ ,  $V_{DD} = 4.5$  to  $5.5\text{V}$ ,  $V_{SS} = 0\text{V}$ ))

参数 parameter	符号 sign	最小 min	典型 typical	最大 max	单位 unit	测试条件 Test conditions
数据传输速度 Data transmission speed	f <sub>DI</sub> N	---	800	1100	KHZ	占空比 67%（数据 1） Duty cycle 67% (Data 1)
DOUT 传输延迟 DOUT transmission delay	T <sub>PLZ</sub>	---	---	200	ns	DIN→DOUT
Iout 上升时间 Iout rising time	T <sub>r</sub>	---	----	400	ns	V <sub>DS</sub> =1.5V I <sub>OUT</sub> =12mA
	T <sub>f</sub>	---	----	400	ns	



### LED 特性参数（Characteristic parameters of LED）

	参考值 Reference value
RGB 通道恒流 Constant current of RGB channels	12mA
红光亮度 Red light brightness	250-400mcd
绿光亮度 Green light brightness	600-1000mcd
蓝光亮度 Blue light brightness	200-350mcd
红光波长 Red light wavelength	620-630nm
绿光波长 Green light wavelength	515-530nm
蓝光波长 Blue light wavelength	460-475nm



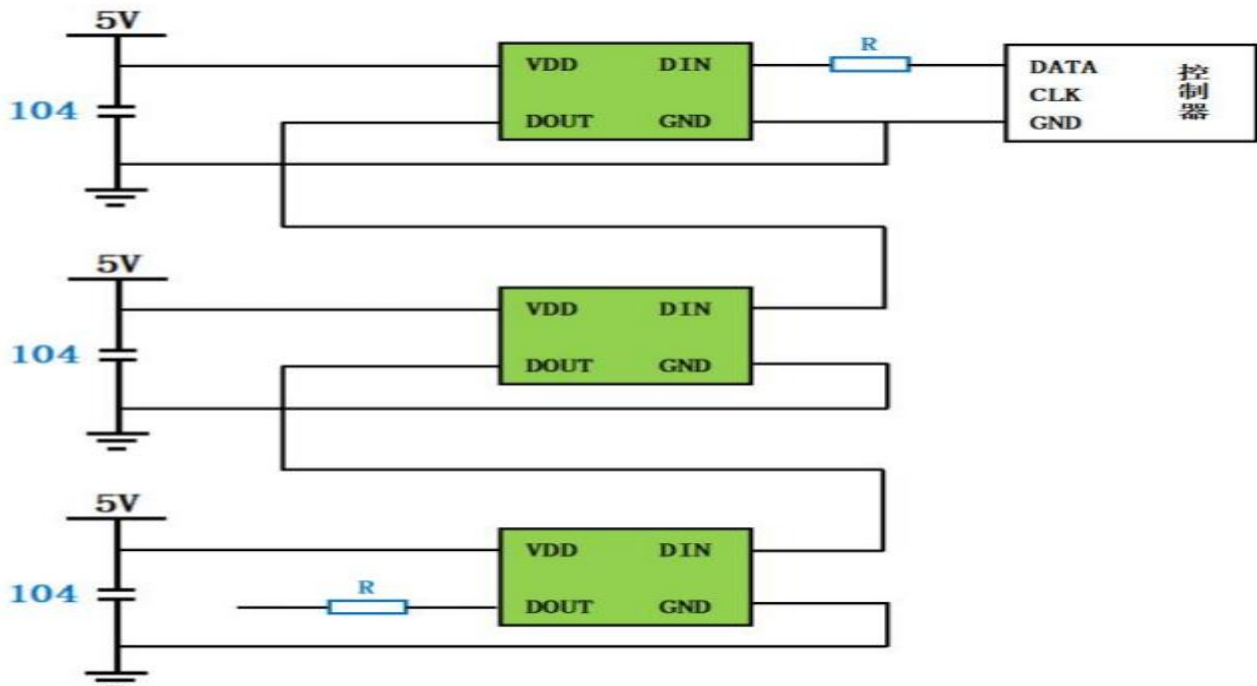
## 24bit 数据结构 (Data structure) :

G7	G6	G5	G4	G3	G2	G1	G0	R7	R6	R5	R4
R3	R2	R1	R0	B7	B6	B5	B4	B3	B2	B1	B0

注：高位先发，按照 GRB 的顺序发送数据 (G7 → G6 → B0)

Note: The high bits are sent first, and the data is sent in the order of GRB (G7 → G6 → B0)

## 典型应用电路 (Typical application circuit)



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内部信号输入输出引脚，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；

应用一：用于软灯灯或硬灯条的，灯珠间传输距离短的，建议在信号及时钟线输入输出端各串接保护电阻，即

R1=R0约500欧；

应用二：用于模组或一般异形产品，灯珠间传输距离长，因线材及传输距离不同，在信号及时钟线两端串接的保护电阻会略有不同；以实际使用情况定。

In actual application circuits, in order to prevent the instantaneous high voltage generated during hot plugging of the product during testing from damaging the input and output pins of the internal signals of the IC, protective resistors should be connected in series at the signal input and output terminals. In addition, in order to make the various IC chips work more stably, decoupling capacitors between each lamp bead are essential;

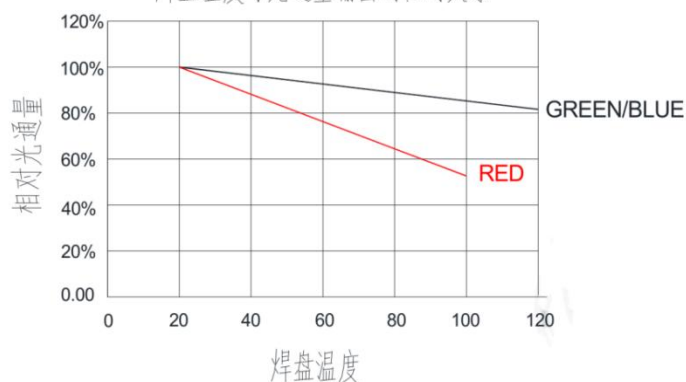
Application 1: For soft lights or hard light bars with a short transmission distance between lamp beads, it is recommended to connect protective resistors in series at each of the signal and clock line input and output terminals, that is, R1 = R0 is approximately 500 ohms;

Application 2: For modules or general special-shaped products with a long transmission distance between lamp beads, due to different wire materials and transmission distances, the protective resistors connected in series at both ends of the signal and clock lines will be slightly different; it depends on the actual usage.



光电特性 (photoelectric characteristics)

焊盘温度与光通量输出的相对关系



波长特性

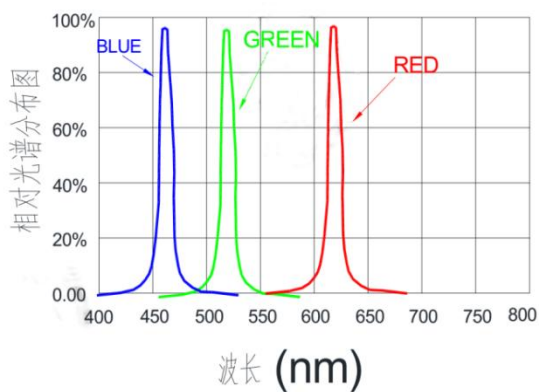
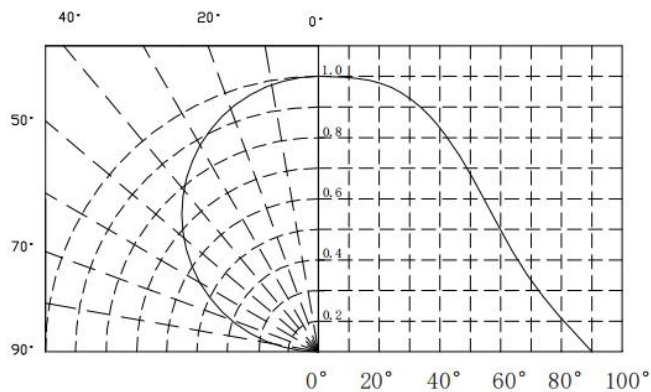


Diagram characteristics of radiation







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## 测试项目及条件 (TEST ITEMS AND RESULTS)

试验项目 Test Items	实验条件 Test Conditions	试验数量 Quantity	判断标准 Judging Criteria
Solderability 可焊性试验	焊接温度 ( Solder Temperature ) : 300℃ 焊接时间 ( Solder Duration ) : ( 3.5±0.5 ) sec.	22PCS	上锡面积在95%以上 Solderable Area Over 95%
Temperature Cycle 冷热冲击	-40℃ 20min↓ 5 min 100℃ 20min 100 cycles	22PCS	C=0 & I*
High Temperature Storage 高温储存	Ta=85℃ 1000 hrs	22PCS	C=0 & I*
Life Test 寿命测试	Ta=25℃ 1000 hrs@5v	22PCS	C=0 & I*
Low Temperature Storage 低温储存	Ta=-35℃ 1000 hrs	22PCS	C=0 & I*

## 失效判断标准 ( Criteria For Judging Damage )

Items 测试项目	Symbol 符号	Test Conditions 测试条件	Criteria For Judging Damage I* 失效判断标准 I*	Criteria For Judging Damage I** 失效判断标准 I**
Forward Voltage 正向电压	V <sub>F</sub>	I <sub>F</sub> = 12mA	≥USL×1.2	≥USL
Luminous Intensity 光强	I <sub>v</sub>	I <sub>F</sub> = 12mA	≤LSL×0.5	≤LSL

\* USL: 标准值上限值, LSL: 标准值下限值      \* USL: Upper Standard Level, LSL: Lower Standard Level

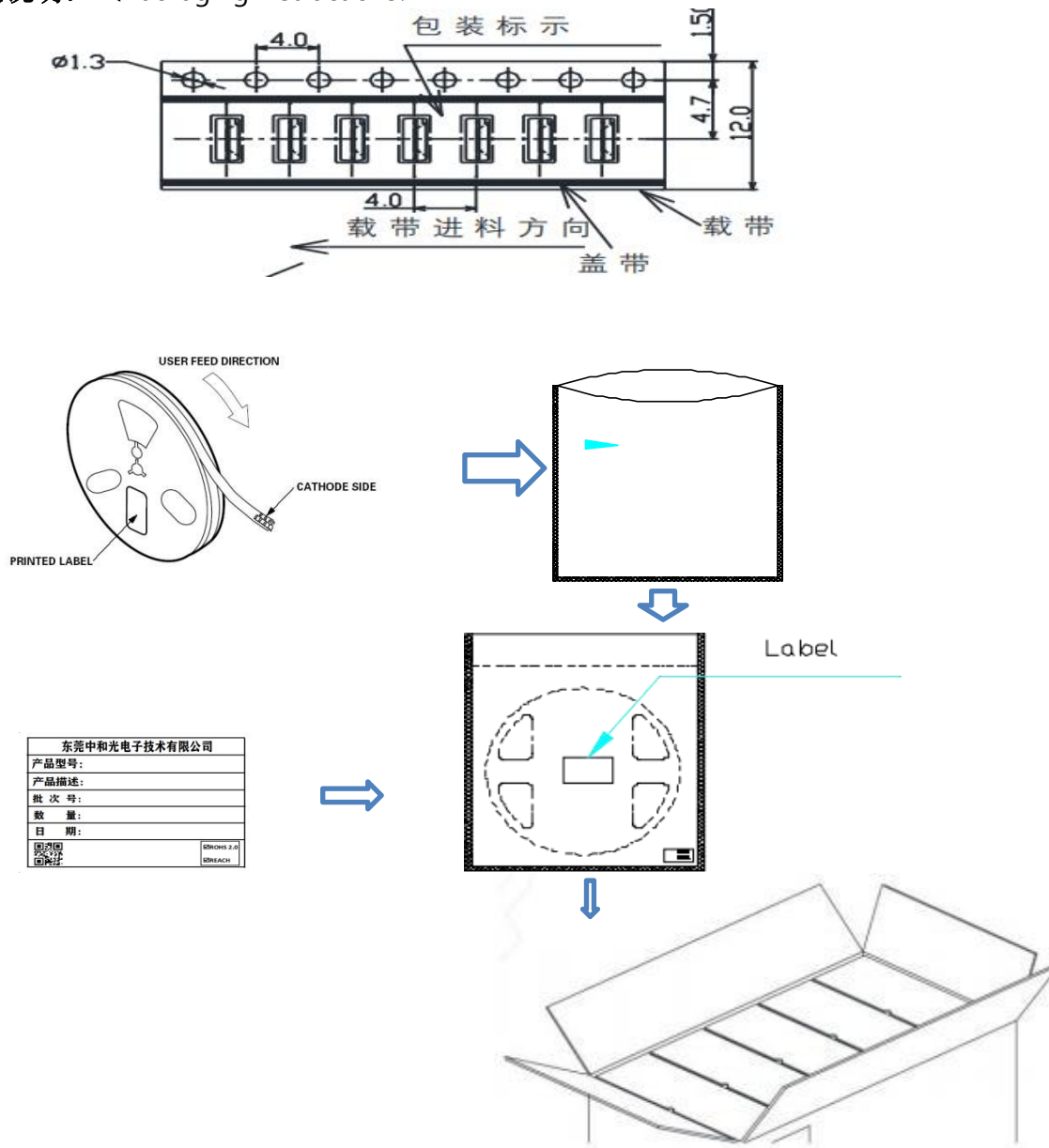


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## 包装说明: (Packaging Instructions)



说明: 1: 表面贴装led采用卷盘包装, led在防静电包装袋包装后再装入纸箱中, 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。

2: 卷盘两种包装数量, 小盘为2000pcs/盘, 大盘为8000pcs/盘。内附干燥剂, 湿度卡。

### Instructions:

1: Surface mount LEDs are packaged in reels. LEDs are packaged in anti-static bags and then placed in cartons. Cartons are used to protect LEDs from mechanical shock during transportation. Cartons are not waterproof, so please pay attention to moisture-proof and waterproof.

2: There are two packaging quantities for reels. The small reel is 2000pcs/reel, and the large reel is 8000pcs/reel. Desiccant and humidity cards are included.