

# APPROVAL SHEET

**SA04X, SA06X**

**±1%, ±5%, Convex Type**

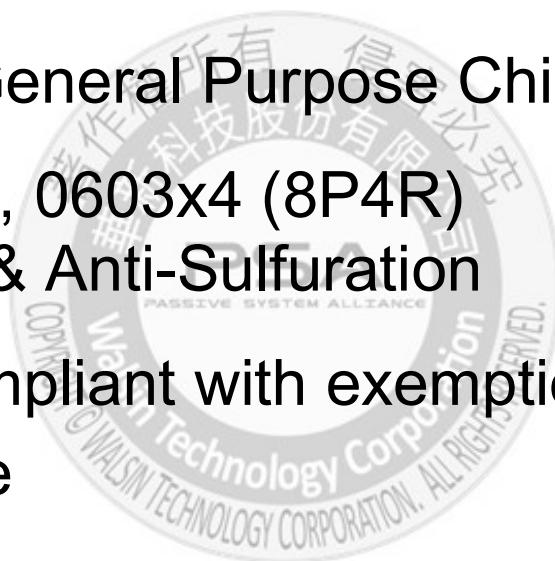
**Thick Film General Purpose Chip-R Array**

**Size 0402x4, 0603x4 (8P4R)**

**Automotive & Anti-Sulfuration**

**RoHS 2 Compliant with exemption 7C-I**

**Halogen free**



\*Contents in this sheet are subject to change without prior notice.

## FEATURE

1. High reliability and stability
2. Sulfuration resistant
3. Automotive grade with AEC Q-200 compliant
4. Higher component and equipment reliability
5. RoHS 2 compliant with exemption 7C-I and Halogen free product
6. Anti-Sulfuration ASTM B-809-95 105°C, 1000hrs compliant

## APPLICATION

- Consumer electrical equipment
- EDP, Computer application
- Telecom
- Automotive application

## DESCRIPTION

The resistors array is constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to within tolerance by laser cutting of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (Pb free) solder alloy.

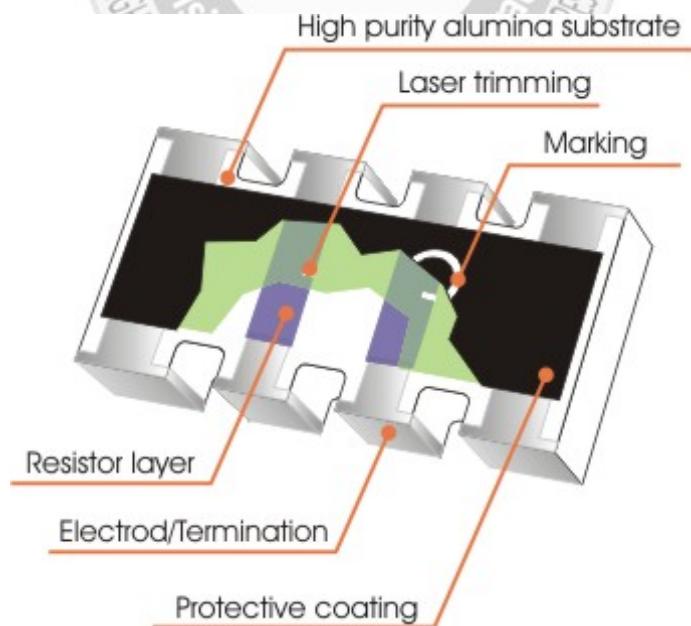


Fig 1. Construction of a Chip-R array(convex Type)

## QUICK REFERENCE DATA

Item	General Specification	
Series No.	SA04X	SA06X
Size	0402x4 (1005x4)	0603x4 (1608x4)
Termination construction	Convex	Convex
Resistance Tolerance	$\pm 5\%$ , $\pm 1\%$	$\pm 5\%$ , $\pm 1\%$
Resistance Range	$3\Omega \sim 1M\Omega$	$1\Omega \sim 1M\Omega$
TCR (ppm/ $^{\circ}\text{C}$ )	$<10\Omega$ : -300 ~ +500 $10\Omega \sim 1M\Omega$ : $\leq \pm 300$	$<10\Omega$ : -200 ~ +400 $10\Omega \sim 1M\Omega$ : $\leq \pm 200$
Max. dissipation at $T_{\text{amb}}=70^{\circ}\text{C}$	1/16 W	1/10 W
Max. Operation Voltage	50V	50V
Max. overload voltage	100V	100V
Operation temperature	$-55 \sim +155^{\circ}\text{C}$	

Note :

1. Climatic category refer to IEC 60068
2. This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
3. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

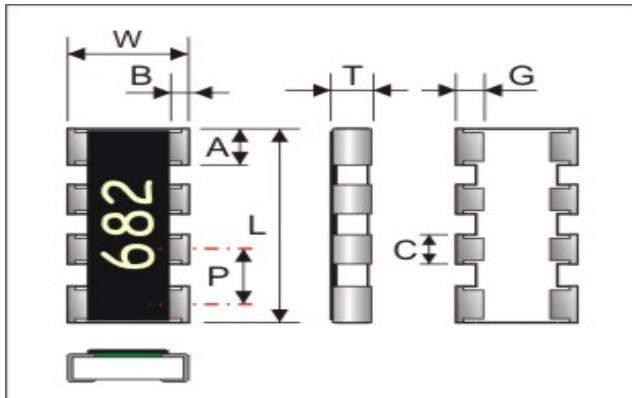
$$\text{RCWV} = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

## For Jumper (0 $\Omega$ ) :

Item	General Specification	
Series No.	SA04X	SA06X
Size code	0402x4 (1005x4)	0603x4 (1608x4)
Resistance Range	$\leq 50\text{m}\Omega$ for P tolerance	
TCR (ppm/ $^{\circ}\text{C}$ )	TCR is not applicable for Jumper product	
Max. dissipation at $T_{\text{amb}}=70^{\circ}\text{C}$	1/16 W	1/10 W
Rated Current	1A	1A
Peak Current	1.5A	3A
Operation temperature	$-55 \sim +155^{\circ}\text{C}$	

## DIMENSIONS (unit : mm)

Series No.	SA04X	SA06X
L	$2.00 \pm 0.10$	$3.20 \pm 0.10$
W	$1.00 \pm 0.10$	$1.60 \pm 0.10$
T	$0.45 \pm 0.10$	$0.50 \pm 0.10$
P	$0.50 \pm 0.05$	$0.80 \pm 0.10$
A	$0.40 \pm 0.10$	$0.60 \pm 0.10$
B	$0.20 \pm 0.10$	$0.30 \pm 0.10$
C	$0.30 \pm 0.05$	$0.40 \pm 0.10$
G	$0.25 \pm 0.10$	$0.30 \pm 0.20$



## CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

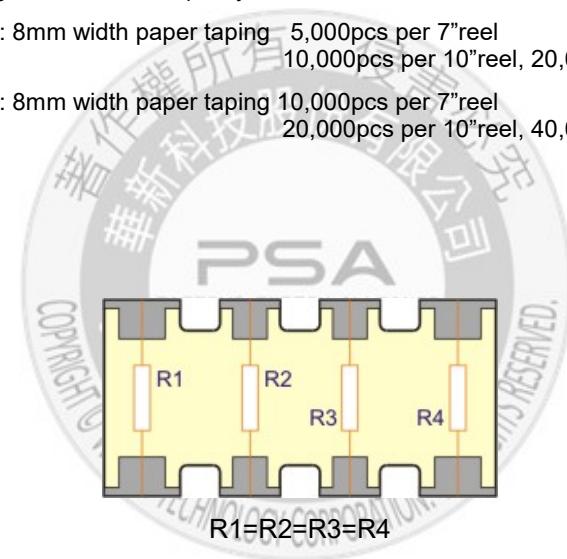
SA04	X	472_	J	T	L
Automotive code SA04 : 0402 x 4 SA06 : 0603 x 4	Type code X : x4 Convex	Resistance code 5%, E24 : 2 significant digits followed by no. of zeros and a blank 220Ω =221_ ("—" means a blank) 1%, E24+E96: 3 significant digits followed by no. of zeros 102Ω =1020 37.4KΩ =3742	Tolerance F : ±1% J : ±5% P : Jumper	Packaging code T : 7" Reeled taping Q : 10" Reeled taping G : 13" Reeled taping B : Bulk	Special code L = Lead free

\* 100% CCD visual inspection to guarantee visual quality !

SA06X, Reeled tape packaging : 8mm width paper taping 5,000pcs per 7"reel  
10,000pcs per 10"reel, 20,000 pcs per 13"reel

SA04X, Reeled tape packaging : 8mm width paper taping 10,000pcs per 7"reel  
20,000pcs per 10"reel, 40,000 pcs per 13"reel

## CONSTRUCTION



## MARKING

**3-digit marking for E24 series ±1% , ±5% products.**

**No marking for chip resistors array E96 series resistance.**

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value.

### Example

Resistance	10Ω	100Ω	6800Ω	47000Ω
Marking code	100	101	682	473

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of  $\pm 5\%$ , The values of the E24 series are in accordance with "IEC publication 60063"

Standard values of nominal resistance are taken from the E24/E96 series for resistors with a tolerance of  $\pm 1\%$ , The values of the E24/E96 series are in accordance with "IEC publication 60063"

### Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2.

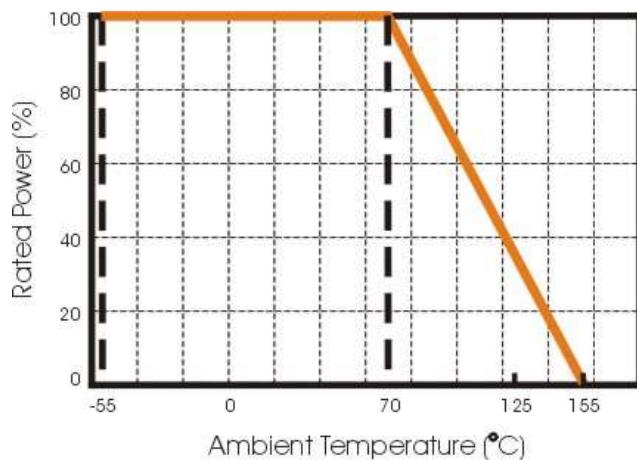


Figure 2. Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

## Storage and Handling Conditions:

1. Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
2. To store products with following condition:

Temperature :5 to 40°C

Humidity :20 to 70% relative humidity

3. Caution:

a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid.

It may cause oxidation of electrode, which easily be resulted in poor soldering.

b. To store products on the shelf and avoid exposure to moisture.

c. Don't expose products to excessive shock, vibration, direct sunlight and so on.

## SOLDERING CONDITION follows J-STD-020D

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds.

Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

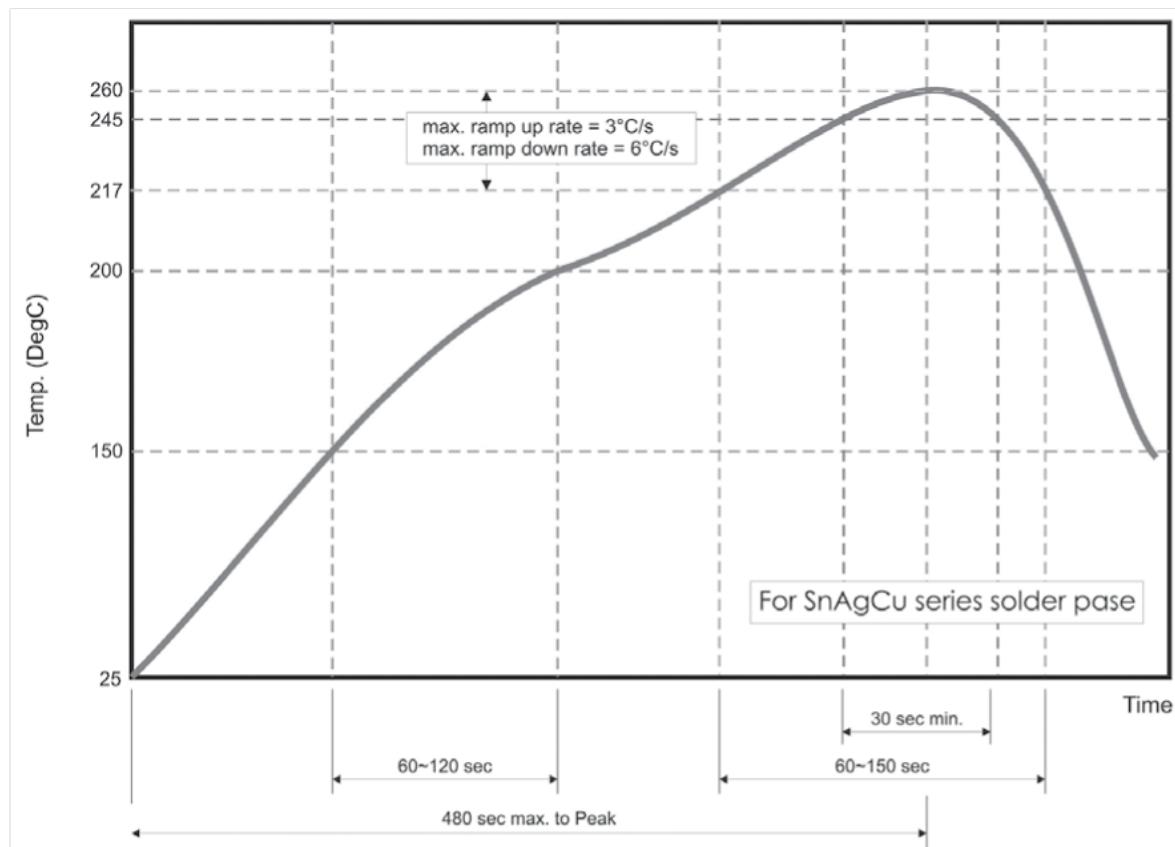


Fig 3. Recommended IR reflow soldering profile for  
SMT process with SnAgCu series solder paste

## TEST AND REQUIREMENTS

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category LCT/UCT/56(rated temperature range : Lower Category Temperature, Upper Category Temperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, subclause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15 °C to 35 °C.

Relative humidity: 45% to 75%.

Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

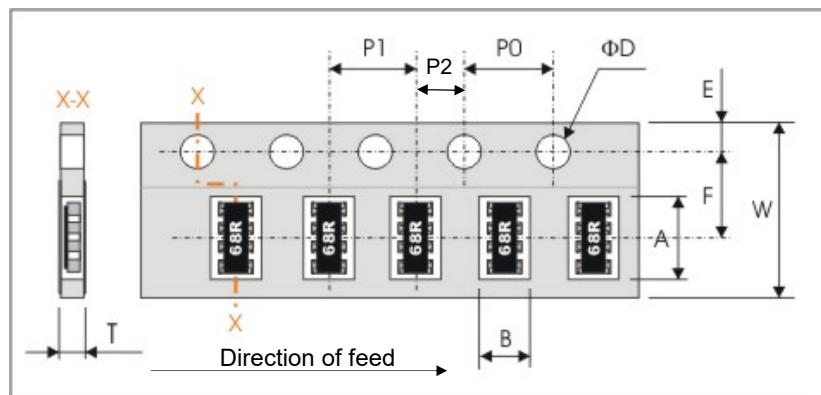
All soldering tests are performed with mildly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
1 High Temperature Exposure (Storage) <b>MIL-STD-202 method 108</b>	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
2 Temperature cycling <b>JESD22 method JA-104</b>	1000 cycles, -55°C ~ +155°C, dwell time 5~10min	ΔR/R max. ±(0.5%+0.05Ω)	<50mΩ
3 Moisture Resistance <b>MIL-STD-202 method 106</b>	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(0.5%+0.10Ω)	<50mΩ
4 Bias Humidity <b>MIL-STD-202 method 103</b>	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
5 Operational Life <b>MIL-STD-202 method 108</b>	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
6 External Visual <b>MIL-STD-883 method 2009</b>	Electrical test not required. Inspect device construction, marking and workmanship.	No visual damage and refer the marking code	
7 Physical Dimension <b>JESD22 Method JB-100</b>	The chip dimension prescribed in the detail specification shall be checked by Protech 2.5D	Within the specification	
8 Short time overload (S.T.O.L) <b>JIS C 5201-1: 1998 Clause 4.13</b>	Permanent resistance change after a 5 second application of a voltage 2,5 times the rated voltage or max. overload voltage, whichever is less	ΔR/R max. ±(2.0%+0.1Ω) No visible damage	<50mΩ
9 Resistance to soldering heat(R.S.H) <b>MIL-STD-202 method 210</b>	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270°C±5°C	ΔR/R max. ±(0.5%+0.05Ω)	<50mΩ

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
10	Thermal shock <b>MIL-STD-202</b> <b>method 107</b>	Test -55 to 155°C / dwell time 15min/ Max transfer time 20sec 300cycles	ΔR/R max. ±(0.5%+0.05Ω) No visible damage
11	ESD <b>AEC-Q200-002</b>	Test contact 1.0KV	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
12	Solderability <b>J-STD-202</b>	a) Bake the sample for 155°C dwell time 4hrs/ solder dipping 235°C / 5sec. b) Steam the sample dwell time 8 hour/ solder dipping 215°C / 5sec. c) Steam the sample dwell time 8 hour/ solder dipping 260°C / 7sec.	95% coverage min., good tinning and no visible damage
13	Electrical Characteristics <b>JISC5201-1: 1998</b> Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 20^\circ\text{C} + 5^\circ\text{C} - 1^\circ\text{C}$ R <sub>1</sub> : Resistance at reference temperature R <sub>2</sub> : Resistance at test temperature	Within the specified tolerance Refer to "QUICK REFERENCE DATA"
14	Board Flex <b>AEC-Q200-005</b>	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 60sec	ΔR/R max. ±(1.0%+0.05Ω). No visible damage
15	Terminal strength <b>AEC-Q200-006</b>	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations
16	Resistance to Solvents <b>MIL-STD-202</b> <b>method 215</b>	Solvent is Isopropyl alcohol, immersion 3mins at 25°C and brush 10 strokes with a toothbrush with a handle made of a non-reactive material (wet bristle) immersion and brush 3 times and then air blow dry	No superficial defect on marking, encapsulation, coating, appearance. Electrical characteristics within products specification and tolerance.
17	Mechanical shock <b>MIL-STD-202</b> <b>method 213</b>	Test 1/2 Sine Pulse/1500g peak/normal duration: 6ms/ Velocity:15.4ft/sec. Three shocks in each direction, total 18 shocks	Within product specification tolerance and no visible damage
18	Vibration <b>MIL-STD-202</b> <b>method 204</b>	Test 5g's for 20min., 12 cycles each of 3 orientations	ΔR/R max. ±(1.0%+0.05Ω) No visible damage
19	Sulfuration test <b>ASTM-B-809</b>	105°C, duration 1000hurs	ΔR/R max. ±(2.0%+0.05Ω)
			<50mΩ

## PACKAGING

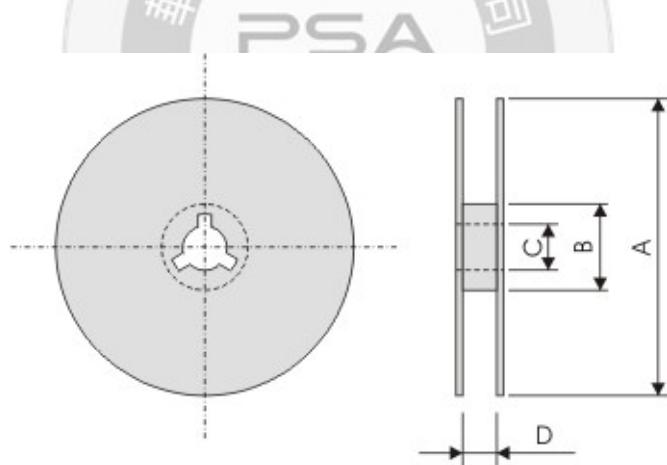
### Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
SA06X	3.60±0.20	2.00±0.20			
SA04X	2.20±0.20	1.20±0.20	8.00±0.30	3.50±0.20	1.75±0.10

Series No.	P1	P0	P2	ΦD	T
SA06X	4.00±0.10			Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.0
SA04X	2.00±0.05	4.00±0.10	2.00±0.10		Max. 0.6

### Reel dimensions



Series No.	Packaging Q'ty	Reel	A	B	C	D
SA06X	5Kpcs/reel	7" reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
	10Kpcs/reel	10" reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
	20Kpcs/reel	13" reel	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
Series No.	Packaging Q'ty	Reel	A	B	C	D
SA04X	10Kpcs/reel	7" reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
	20Kpcs/reel	10" reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
	40Kpcs/reel	13" reel	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5