

**UNI-ROYAL**  
厚聲集團

# DATA SHEET

**Product Name** Complete Pb-Free Thick Film Chip Resistors

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**Part Name** PF Series

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Brands *RoyalOhm* *UniOhm*



## 1. Scope

- 1.1 This specification for approve relates to the Complete Pb-Free Thick Film Chip Resistors manufactured by UNI-ROYAL
- 1.2 Total Lead-Free in Whole resistor body
- 1.3 Reduction of assembly costs and matching with placement machine
- 1.4 Suitable for both wave & re-flow soldering

## 2. Explanation of Part No. System

Part No. includes 14 codes shown as below:

2.1 1st~4th codes: Part name. E.g.: PF0A, PF01, PF02, PF03, PF05, PF06, PF07, PF11, PF10, PF12

2.2 5th~6th codes: Power rating.

E.g.: W=Normal Size		"1~G" = "1~16"								
Wattage	1/32	3/4	1/2	1/3	1/4	1/8	1/10	1/16	1/20	1
Normal Size	WH	07	W2	W3	W4	W8	WA	WG	WM	1W

If power rating is lower or equal than 1 watt, 5<sup>th</sup> code would be "W" and 6<sup>th</sup> code would be a number or letter.

E.g.: WA=1/10W                      W4=1/4W

2.3 7<sup>th</sup> code: Tolerance. E.g.: D=±0.5%              F=±1%              G=±2%              J=±5%              K= ±10%

2.4 8<sup>th</sup>~11<sup>th</sup> codes: Resistance Value.

2.4.1 If value belongs to standard value of ≥5% series, 8<sup>th</sup> code would be zero, 9<sup>th</sup>~10<sup>th</sup> codes are significant figures of the resistance and 11<sup>th</sup> code is the power of ten.

2.4.2 If value belongs to standard value of ≤2% series, 8<sup>th</sup>~10<sup>th</sup> codes are significant figures of the resistance, and 11<sup>th</sup> code is the power of ten.

2.4.3 11<sup>th</sup> codes listed as following:

0=10<sup>0</sup>    1=10<sup>1</sup>    2=10<sup>2</sup>    3=10<sup>3</sup>    4=10<sup>4</sup>    5=10<sup>5</sup>    6=10<sup>6</sup>    J=10<sup>-1</sup>    K=10<sup>-2</sup>    L=10<sup>-3</sup>    M=10<sup>-4</sup>

2.5 12<sup>th</sup>~14<sup>th</sup> codes.

2.5.1 12<sup>th</sup> code: Packaging Type. E.g.: C=Bulk              T=Tape/Reel

2.5.2 13<sup>th</sup> code: Standard Packing Quantity.

4=4000pcs    5=5000pcs              C=10000pcs              D=20000pcs              E=15000pcs

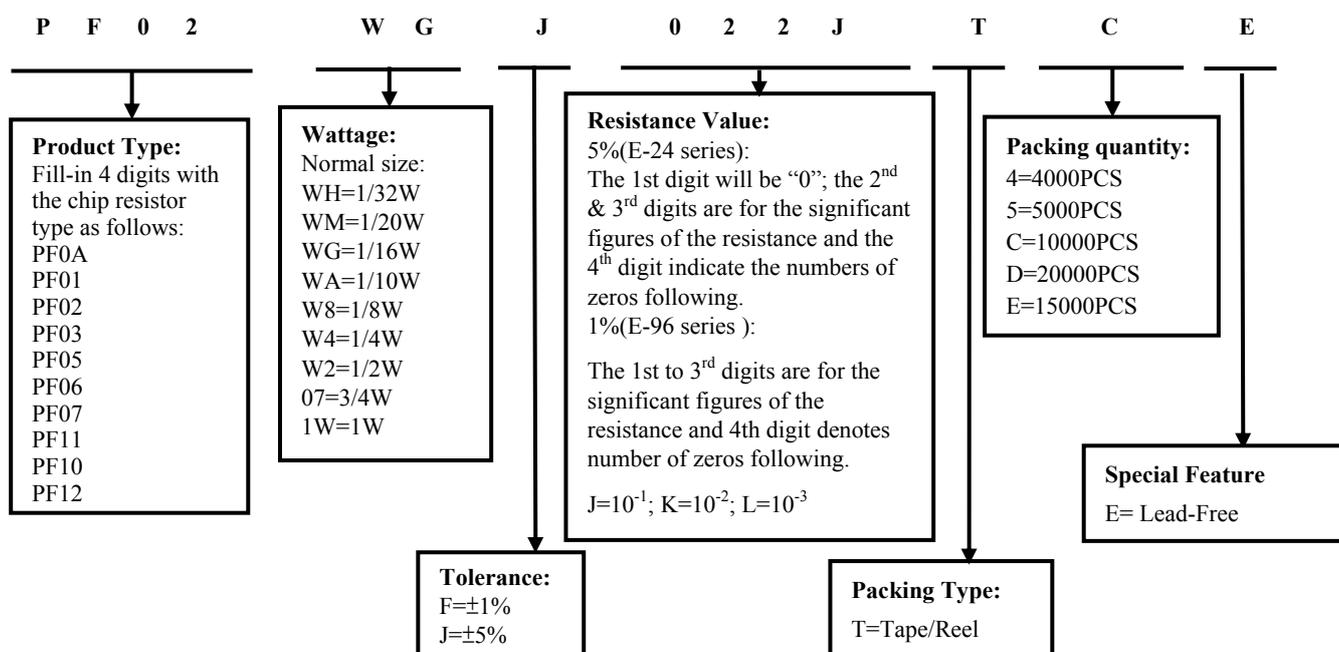
Chip Product: BD=B/B-20000pcs              TC=T/R-10000pcs

2.5.3 14<sup>th</sup> code: Special features.

E = Environmental Protection, Lead Free, or Standard type.

## 3. Ordering Procedure

(Example: PF02 1/16W ±5% 2.2Ω T/R-10000)



#### 4. Marking

(1) For PF0A、PF01 and PF02 size. Due to the very 01005、0201、0402 small size of the resistor's body, there is no marking on the body.



Normally, the making of 0Ω PF03, 0Ω PF05, 0Ω PF06, 0Ω PF07, 0Ω PF11, 0Ω PF10, 0Ω PF12 resistors as following



0 → 0Ω

(2) ±5% Tolerance: The first two digits are significant figures of resistance and the third denotes number of zeros following



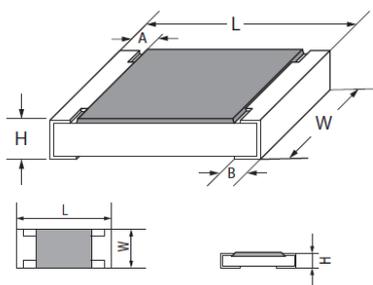
333 → 33KΩ

(3) ±1% Tolerance: 4 digits, first three digits are significant; fourth digit is number of zeros. Letter r is decimal point.



2701 → 2.7KΩ

#### 5. Dimension

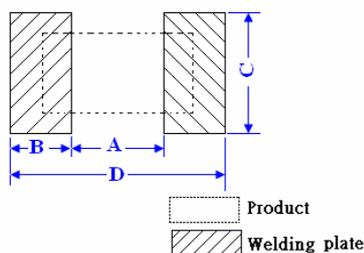


Type	Dimension(mm)				
	L	W	H	A	B
PF0A(01005)	0.40±0.02	0.20±0.02	0.13±0.02	0.10±0.05	0.10±0.03
PF01(0201)	0.60±0.03	0.30±0.03	0.23±0.03	0.10±0.05	0.15±0.05
PF02(0402)	1.00±0.10	0.50±0.05	0.35±0.05	0.20±0.10	0.25±0.10
PF03(0603)	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
PF05(0805)	2.00±0.15	1.25±0.15/-0.10	0.55±0.10	0.40±0.20	0.40±0.20
PF06(1206)	3.10±0.15	1.55±0.15/-0.10	0.55±0.10	0.45±0.20	0.45±0.20
PF07(1210)	3.10±0.10	2.60±0.20	0.55±0.10	0.50±0.25	0.50±0.20
PF11(1812)	4.50±0.20	3.20±0.20	0.55±0.20	0.50±0.20	0.50±0.20
PF10(2010)	5.00±0.10	2.50±0.20	0.55±0.10	0.60±0.25	0.50±0.20
PF12(2512)	6.35±0.10	3.20±0.20	0.55±0.10	0.60±0.25	0.50±0.20

#### 6. Resistance Range

Type	Power Rating at 70°C	Max. Working Voltage	Max. Overload Voltage	Dielectric withstanding Voltage	Resistance Value of Jumper	Rated Current of Jumper	Max. Overload Current of Jumper	Resistance Range 1%	Resistance Range 5%	Operating Temperature
PF0A	1/32W	15V	30V	--	<50mΩ	0.5A	1A	10Ω~10MΩ	1Ω~10MΩ	-55°C~125°C
PF01	1/20W	25V	50V	--	<50mΩ	0.5A	1A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF02	1/16W	50V	100V	100V	<50mΩ	1A	2A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF03	1/10W	75V	150V	300V	<50mΩ	1A	2A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF05	1/8W	150V	300V	500V	<50mΩ	2A	5A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF06	1/4W	200V	400V	500V	<50mΩ	2A	10A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF07	1/2W	200V	500V	500V	<50mΩ	2A	10A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF11	3/4W	200V	500V	500V	<50mΩ	2A	10A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF10	3/4W	200V	500V	500V	<50mΩ	2A	10A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C
PF12	1W	200V	500V	500V	<50mΩ	2A	10A	1Ω~10MΩ	1Ω~10MΩ	-55°C~155°C

## 7. Recommend the size of welding plate

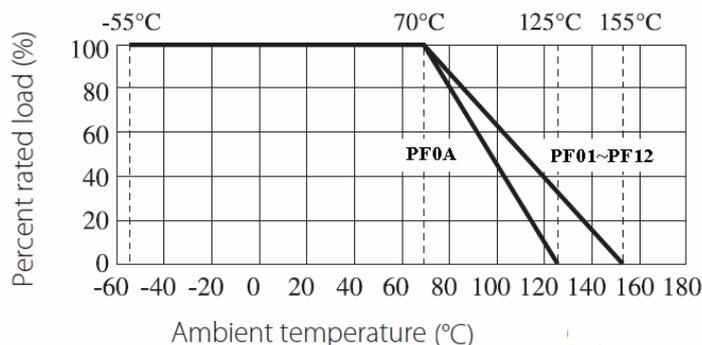


Type	Dimension(mm)			
	A	B	C	D
PF0A	0.14±0.03	0.2±0.03	0.2±0.03	0.54±0.03
PF01	0.25±0.15	0.225±0.15	0.3±0.03	1.0±0.05
PF02	0.50±0.05	0.45±0.05	0.5±0.05	1.4±0.05
PF03	0.8±0.05	0.65±0.05	0.8±0.05	2.1±0.05
PF05	1.0±0.1	1.0±0.1	1.3±0.1	3.0±0.1
PF06	2.0±0.1	1.1±0.1	1.6±0.1	4.2±0.1
PF07	2.0±0.1	1.1±0.1	2.6±0.1	4.2±0.1
PF10	3.6±0.1	1.3±0.1	2.6±0.1	6.2±0.1
PF11	3.0±0.1	1.4±0.1	3.3±0.1	5.8±0.1
PF12	4.9±0.1	1.6±0.1	3.3±0.1	8.1±0.1

## 8. Derating Curve

Resistors shall have a power rating based on continuous load operation at an ambient temperature from -55°C to 70°C. For temperature in excess of 70°C, the load shall be derated as shown in figure 1

Figure 1



Voltage rating:

Resistors shall have a rated direct-current (DC) continuous working

voltage or an approximate sine-wave root-mean-square (RMS) alternating-current (AC) continuous working voltage at commercial-line frequency and waveform corresponding to the power rating, as determined from the following formula:

$$RCWV = \sqrt{P \times R}$$

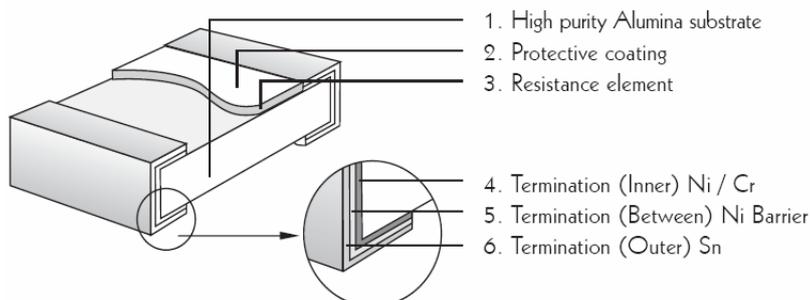
Where: RCWV commercial-line frequency and waveform (Volt.)

P = power rating (WATT.) R = nominal resistance (OHM)

In no case shall the rated DC or RMS AC continuous working voltage be greater than the applicable maximum value.

The overload voltage is 2.5 times RCWV or Max. Overload voltage whichever is less

## 9. Structure



## 10. Performance Specification

Characteristic	Limits		Test Methods (GB/T5729&JIS-C-5201&IEC60115-1)
◎ Temperature Coefficient	<b>PF0A:</b> $1\Omega \leq R \leq 10\Omega$ : -200~600PPM/°C $10\Omega < R \leq 100\Omega$ : $\pm 300$ PPM/°C $> 100\Omega$ : $\pm 200$ PPM/°C <b>PF01:</b> $1\Omega \leq R \leq 10\Omega$ : -100~350PPM/°C $> 10\Omega$ : $\pm 200$ PPM/°C <b>PF02, PF03, PF05, PF06, PF07, PF11, PF10, PF12:</b> $1\Omega \leq R \leq 10\Omega$ : $\pm 400$ PPM/°C $10\Omega < R \leq 100\Omega$ : $\pm 200$ PPM/°C $> 100\Omega$ : $\pm 100$ PPM/°C		4.8 Natural resistance changes per temp. Degree centigrade $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (PPM/°C)}$ R <sub>1</sub> : Resistance Value at room temperature (t <sub>1</sub> ) ; R <sub>2</sub> : Resistance at test temperature (Upper limit temperature or Lower limit temperature) t <sub>1</sub> : +25°C or specified room temperature t <sub>2</sub> : Upper limit temperature or Lower limit temperature test temperature
◎ *Short-time overload	$\pm 1\%$	$\pm(1.0\% + 0.1\Omega)$	4.13 Permanent resistance change after the application of a potential of 2.5 times RCWV or Max. Overload Voltage whichever less for 5 seconds..  Apply max Overload current for 0Ω
	$\pm 5\%$	$\pm(2.0\% + 0.1\Omega)$	
	PF0A	$\pm(2.0\% + 0.1\Omega)$	
	* <50mΩ		
* Dielectric withstanding voltage	No evidence of flashover mechanical damage, arcing or insulation breaks down.		4.7 Resistors shall be clamped in the trough of a 90°C metallic v-block and shall be tested at ac potential respectively specified in the given list of each product type for 60-70 seconds.
◎ *Solderability	Coverage must be over 95%.		Wave solder: Test temperature of solder: 245°C±3°C dipping time in solder: 2-3 seconds.
	Go up tin rate bigger than half of end pole		Reflow: 
◎ Rapid change of temperature	$\pm 1\%$	$\pm(0.5\% + 0.05\Omega)$	4.19 30 min at lower limit temperature and 30 min at upper limit temperature , 100 cycles.
	$\pm 5\%$	$\pm(1.0\% + 0.05\Omega)$	
	PF0A	$\pm(1.0\% + 0.05\Omega)$	
◎ Soldering heat	$\pm(1\% + 0.05\Omega)$		4.18 Dip the resistor into a solder bath having a temperature of 260°C±5°C and hold it for 10±1 seconds.
Terminal bending	$\pm(1\% + 0.05\Omega)$		4.33 Twist of test board: Y/X = 3/90 mm for 60Seconds
* Insulation resistance	$\geq 1,000 \text{ M}\Omega$		4.6 The measuring voltage shall be ,measured with a direct voltage of (100±15)V or a voltage equal to the dielectric withstanding voltage., and apply for 1min.

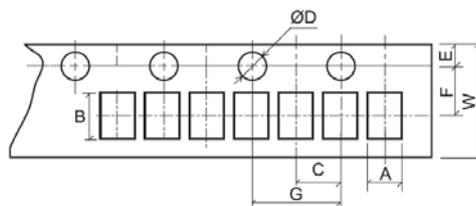
◎ Humidity ( steady state )	±1%	±(0.5%+0.1Ω)	4.24 Temporary resistance change after 240 hours exposure in a humidity test chamber controlled at 40±2°C and 90-95% relative humidity,
	±5%	±(3.0%+0.1Ω)	
	PF0A	±(3.0%+0.1Ω)	
◎ *Load life in humidity	±1%	±(1.0%+0.1Ω)	7.9 Resistance change after 1,000 hours (1.5 hours “ON”, 0.5 hour “OFF”) at RCWV in a humidity chamber controlled at 40°C±2°C and 90 to 95% relative humidity.
	±5%	±(3.0%+0.1Ω)	
	PF0A	±(3.0%+0.1Ω)	
	* <50mΩ		Apply to rated current for 0Ω
◎ *Load life	±1%	±(1.0%+0.1Ω)	4.25.1 Permanent resistance change after 1,000 hours operating at RCWV with duty cycle 1.5 hours “ON”, 0.5 hour “OFF” at 70°C±2°C ambient.
	±5%	±(3.0%+0.1Ω)	
	PF0A	±(3.0%+0.1Ω)	
	* <50mΩ		Apply to rated current for 0Ω
◎ *Low Temperature Storage	±1%	±(1.0%+0.1Ω)	4.23.4 Lower limit temperature , for 2H.
	±5%	±(3.0%+0.1Ω)	
	PF0A	±(3.0%+0.1Ω)	
	* <50mΩ		Apply to rated current for 0Ω
◎ *High Temperature Exposure	±1%	±(1.0%+0.1Ω)	4.23.2 Upper limit temperature , for 16H.
	±5%	±(3.0%+0.1Ω)	
	PF0A	±(3.0%+0.1Ω)	
	* <50mΩ		Apply to rated current for 0Ω
◎ *Leaching	No visible damage		J-STD-002 Test D Samples completely immersed for 30 sec in solder bath at 260°C

The resistors of 0Ω only can do the characteristic noted of \*

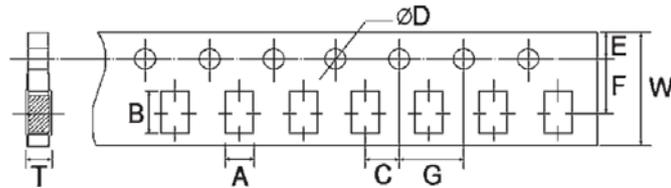
The resistors of 01005 & 0201 only can do the characteristic noted of ◎

## 11. Packing of Surface Mount Resistors

### 11.1 Dimension of Paper Taping :(Unit: mm)

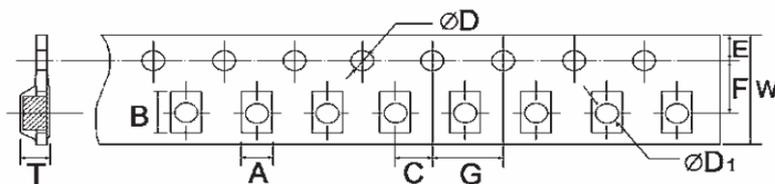


Type	A	B	C ±0.05	+0.1 ΦD -0	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T
PF0A	0.24±0.05	0.45±0.05	2.00	1.50	1.75	3.50	4.00	8.00	0.40±0.1
PF01	0.40±0.05	0.70±0.05	2.00	1.50	1.75	3.50	4.00	8.00	0.42±0.1
PF02	0.65±0.10	1.20±0.10	2.00	1.50	1.75	3.50	4.00	8.00	0.42±0.05



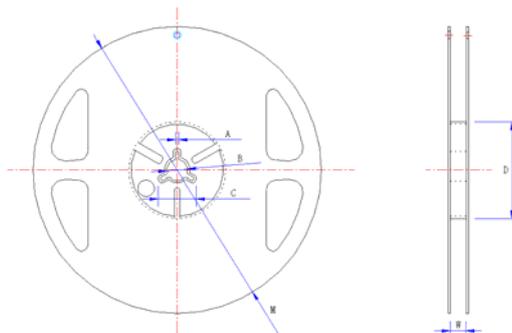
Type	A ±0.2	B ±0.2	C ±0.05	+0.1 ØD -0	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.1
PF03	1.10	1.90	2.00	1.50	1.75	3.50	4.00	8.00	0.67
PF05	1.65	2.40	2.00	1.50	1.75	3.50	4.00	8.00	0.81
PF06	2.00	3.60	2.00	1.50	1.75	3.50	4.00	8.00	0.81
PF07	2.80	3.50	2.00	1.50	1.75	3.50	4.00	8.00	0.75

### 11.2 Dimension of Embossed Taping: (Unit: mm)



Type	A ±0.2	B ±0.2	C ±0.05	+0.1 ØD -0	+0.25 ØD1 -0	E ±0.1	F ±0.05	G ±0.1	W ±0.2	T ±0.1
PF10	2.90	5.60	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00
PF11	3.50	4.80	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00
PF12	3.50	6.70	2.00	1.50	1.50	1.75	5.50	4.00	12.00	1.00

### 11.3 Dimension of Reel : (Unit: mm)



Type	Taping	Qty/Reel	A ±0.5	B ±0.5	C ±0.5	D ±1	M ±2	W ±1
PF0A	Paper	20,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF01	Paper	15,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF02	Paper	10,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF03	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF05	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF06	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF07	Paper	5,000pcs	2.0	13.0	21.0	60.0	178.0	10.0
PF10	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
PF11	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8
PF12	Embossed	4,000pcs	2.0	13.0	21.0	60.0	178.0	13.8

**12. Note**

- 12.1. UNI-ROYAL recommend the storage condition temperature: 15°C~35°C, humidity :25%~75%.  
(Put condition for individual product).Even under UNI-ROYAL recommended storage condition, solderability of products over 1 year old.  
(Put condition for each product) may be degraded.
- 12.2. Store / transport cartons in the correct direction, which is indicated on a carton as a symbol.  
Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.
- 12.3. Product performance and soldered connections may deteriorate if the products are stored in the following places:
- Storage in high Electrostatic.
  - Storage in direct sunshine 、 rain and snow or condensation.
  - Where the products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, NO<sub>2</sub>.
- 12.4. The products are used in circuit board thickness greater than 1.6mm. If customers use less than the thickness of the circuit board that you should confirm with the company, in order to recommend a more suitable product.

**13. Record**

Version	Description of amendment	Page	Date	Amended by	Checked by
1	First issue of this specification	1~8	Mar.20, 2018	Chen Haiyan	Chen Nana
2	Modify PF01 packing quantity	8	Jun.06, 2018	Chen Haiyan	Chen Nana
3	Modify the Performance Specification	5~6	Feb.14, 2019	Chen Haiyan	Xu Yuhua

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