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SPECIFICATION FOR APPROVAL

DATE：

CUSTOMER：

PART NAME： Thick Film High Power Chip Resistor

CUSTOMER'S DWG. NO.：

CUSTOMER'S PART NO.：

PDC PART NO.： **FPF-ME SERIES APPROVED**

DESCRIPTION.：

ACTION / RESULT	" V "	CUSTOMER'S SIGNATURE	NOTE
FULL APPROVED			
CONDITIONAL APPROVED			
REJECTED			

OUR ACTION	SIGNATURE
PREPARED By	Jenny Tseng
CHECKED By	Tony Chou
APPROVED By	Byron Tsai

CUSTOMER SIGNATURE FOR ACCEPTANCE

Contents.

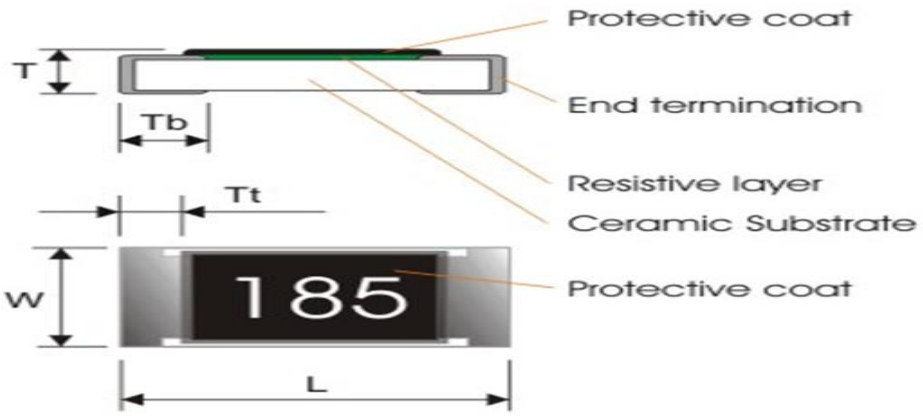
1. Features

- High reliability and stability ±1%.
- Sulfuration resistant by Oil 105'C soaked with 3.5% sulphur 500hrs.
- Sulfuration resistant by ASTM B-809 105'C 1000hrs.
- Automotive grade AEC Q-200 & Military Compliant.
- 100% CCD inspection.
- RoHS 2 Compliant with exemption 7C-1 and Halogen free products.

2. Applications

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

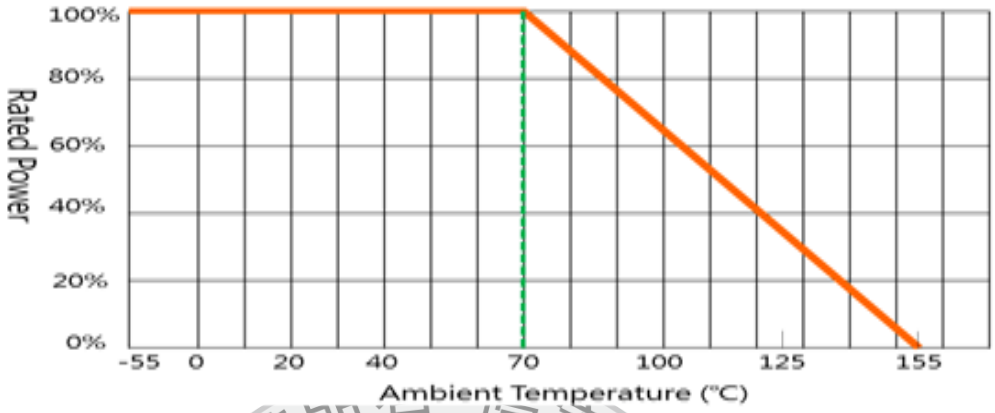
3. Dimension and Construction



(mm)	FPF25	FPF12	FPF06	FPF05	FPF03	FPF02
L	6.30 ± 0.20	3.10 ± 0.10	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	3.10 ± 0.20	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.15	0.45 ± 0.10	0.35 ± 0.05
Tt	0.60 ± 0.25	0.50 ± 0.20	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.20	0.25 ± 0.10
Tb	1.80 ± 0.25	0.50 ± 0.20	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.20	0.20 ± 0.10

4. Power Derating Curve

Operating Temperature Range: -55 to +155℃



5. Rating

5.1 Resistor

Item	General Specification					
Series No.	FPF25	FPF12	FPF06	FPF05	FPF03	FPF02
Size code	2512(6432)	1210(3225)	1206(3216)	0805(2012)	0603(1608)	0402(1005)
Resistance Range	1Ω~1MΩ ,Jumper (0Ω)					
Resistance Tolerance	± 1%, E96+E24 ± 5%, E24					
TCR (ppm/°C) 100Ω ~ 1MΩ <100Ω	≤ ± 100 ≤ ± 200	≤ ± 100 ≤ ± 200	≤ ± 100 ≤ ± 200	≤ ± 100 ≤ ± 200	≤ ± 100 ≤ ± 200	≤ ±100 ≤ ± 200
Max. dissipation @ T_{amb}=70°C	2 W	1/2 W	1/2 W	1/4 W	1/8 W	1/8 W
Max. Operation Voltage	250V	200V	200V	150V	75V	50V
Max. Overload Voltage	500V	400V	400V	300V	150V	100V
Operation temperature	-55 ~ +155°C					

Notes:

1. Rated Working Voltage V= $\sqrt{P * R}$ or Max. Working Voltage whichever is lower.
2. V: Working Voltage(V), P: Rated Power(W), R: Resistance Value(Ω).
3. Please consider the resistance variance may from soldering pad/trace/amount influence, and recommend keep the surface temperature do not exceed 105℃ when operating.

5.2 Jumper, or 0 ohm

Item	General Specification					
Series No.	FPF25	FPF12	FPF06	FPF05	FPF03	FPF02
Size code	2512(6432)	1210(3225)	1206(3216)	0805(2012)	0603(1608)	0402(1005)
Resistance Range	≤20mΩ					≤50mΩ
TCR (ppm/°C)	TCR is not applicable for Jumper product					
Max. dissipation @ T_{amb}=70°C	2 W	1/2 W	1/2 W	1/4 W	1/8 W	1/8 W
Rated Current	10A	5A	5A	4A	2A	1.5A
Peak Current	25A	12.5A	12.5A	10A	5A	3.8A
Operation temperature	-55 ~ +155°C					

6. Part Number

Type	Size	Tolerance	Packing	Watt	R Code	TCR	Grade
FPF	**02** 0402	**F** ±1%	Paper Tape:	**-**	**XXXX**	**-**	**ME**
High	**03** 0603	**J** ±5%	0402.0603	As	**XXX**	As	AEC-Q200
Power	**05** 0805		0805.1206	Rating		Rating	
	06 1206		**T** 5Kpcs	Info	**±1%**	Info	Anti-Sulfur
	12 1210		**V** 10Kpcs		4 digits		ASTM B-809
	25 2512		**W** 20Kpcs				105'C 1000hrs
			Plastic Tape:		**±5%**		Or
			2010.2512		3 digits		Oil 105'C
			P 4Kpcs				Soaked with
			X 8Kpcs				3.5% Sulphur
			Y 16Kpcs				500hrs

Example：

FPF02FV-1004-ME

➔0402 size, tolerance 1%, 10kpcs paper tape, 1/8W, 1 MΩ, Aec-Q200+Anti-Sulfur.

FPF25JP-472 -ME

➔2512 size, tolerance 5%, 4kpcs plastic tape, 1W, 4.7 KΩ, Aec-Q200+Anti-Sulfur.

7. Marking/Soldering

Size \ Nr. Of digit of code\tolerance	± 1%, ±.5%
2512/1210/1206/0805	± 1%: 4 digits marking; ± 5%: 3 digits marking
0603	3 digits marking
0402	N0 MARKING

Size \ Nr. Of digit of code\tolerance	Jumper (0Ω)
2512	4 digits marking
1210/1206/0805/0603	3 digits marking
0402	N0 MARKING

3 digits marking （ ±5% 2512,1210,1206, 0805, 0603）

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

3 digits marking（±1% 0603）

Nominal resistance	Description
1.E24 series	2 significant digits followed by No. of zeros .As *0603 WR06X* ±5% Example

RESISTANCE	4.7Ω	47Ω	470Ω	4K70	47K0	470K	4M70
3 digits marking	4R7	470	471	472	473	474	475

2.E96 series

The 1st two digit codes are referring to the CODE on the table, the 3rd code is the index of resistance value.
Repeat values between E24 and E96 series, whose marking are based on the E96 CODE table.

Code	Z	Y	X	A	B	C	D	E	F	G
Multiplier	10^{-3}	10^{-2}	10^{-1}	10^{0}	10^{1}	10^{2}	10^{3}	10^{4}	10^{5}	10^{6}

Example

RESISTANCE	1.78Ω	17.8Ω	178Ω	1K78	17K8	178K	1M78
3 digits marking	25Y	25X	25A	25B	25C	25D	25E

3. Remark	There is no marking for the items not under E24 and E96 series.

E96 CODE table:

CODE	R value	CODE	R-value	CODE	R-Value	CODE	R-value	CODE	R-value	CODE	R-value	CODE	R-value	CODE	R-value
01	**100**	13	**133**	25	**178**	37	**237**	49	**316**	61	**422**	73	**562**	85	**750**
02	**102**	14	**137**	26	**182**	38	**243**	50	**324**	62	**432**	74	**576**	86	**768**
03	**105**	15	**140**	27	**187**	39	**249**	51	**332**	63	**442**	75	**590**	87	**787**
04	**107**	16	**143**	28	**191**	40	**255**	52	**340**	64	**453**	76	**604**	88	**806**
05	**110**	17	**147**	29	**196**	41	**261**	53	**348**	65	**464**	77	**619**	89	**825**
06	**113**	18	**150**	30	**200**	42	**267**	54	**357**	66	**475**	78	**634**	90	**845**
07	**115**	19	**154**	31	**205**	43	**274**	55	**365**	67	**487**	79	**649**	91	**866**
08	**118**	20	**158**	32	**210**	44	**280**	56	**374**	68	**499**	80	**665**	92	**887**
09	**121**	21	**162**	33	**215**	45	**287**	57	**383**	69	**511**	81	**681**	93	**909**
10	**124**	22	**165**	34	**221**	46	**294**	58	**392**	70	**523**	82	**698**	94	**931**
11	**127**	23	**169**	35	**226**	47	**301**	59	**402**	71	**536**	83	**715**	95	**953**
12	**130**	24	**174**	36	**232**	48	**309**	60	**412**	72	**549**	84	**732**	96	**976**

4 digits marking（±1% 2512,1210,1206, 0805）

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For values below 97Ω6 the R is used as a digit. For values of 100Ω or greater, the first 3 digits are significant, and the fourth digit indicates the number of multiple to follow.

Example

RESISTANCE	Jumper (0Ω)	4.7Ω	10Ω	12Ω	100Ω	6800Ω	47000Ω	470000Ω
3 digits marking ±5% 2512,1210,1206, 0805, 0603 Jumper 1210,1206, 0805, 0603	000	4R7	100	120	101	682	473	474
4 digits marking ±1% 2512,1210,1206, 0805 Jumper 2512	0000	4R70	10R0	12R0	1000	6801	4702	4703

Soldering Reference：Compatible for most industrial soldering request.

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 below Fig.

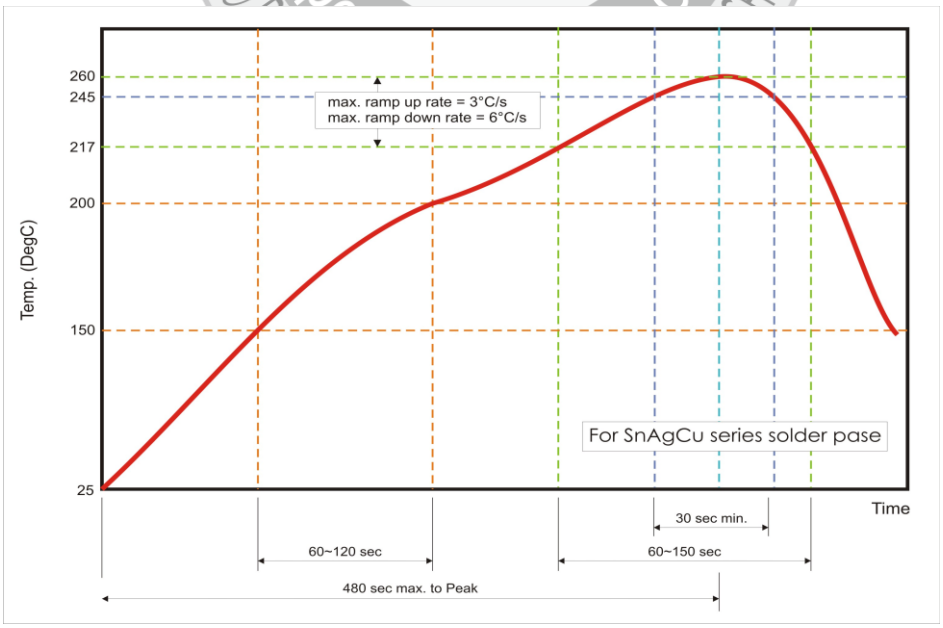
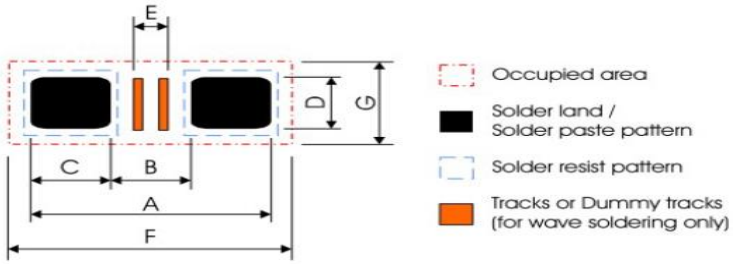


Fig. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

Recommend Solder Pad Dimensions

Footprint Design



Reflow Soldering (unit:mm)

Size	A	B	C	D	E	F	G	Placement Accuracy
01005	0.58	0.18	0.20	0.20	0.10	0.90	0.40	±0.03
0201	0.90	0.30	0.30	0.30	0.20	1.10	0.50	±0.05
0402	1.50	0.50	0.50	0.60	0.10	1.90	1.00	±0.15
0603	2.10	0.90	0.60	0.90	0.50	2.35	1.45	±0.25
0805	2.60	1.20	0.70	1.30	0.75	2.85	1.90	±0.25
1206	3.80	2.00	0.90	1.60	1.60	4.05	2.25	±0.25
1210	3.80	2.00	0.90	2.80	1.60	4.05	3.15	±0.25
1218	3.80	2.00	0.90	4.80	1.40	4.20	5.50	±0.25
2010	5.60	3.80	0.90	2.80	3.40	5.85	3.15	±0.25
2512	7.00	3.80	1.60	3.50	3.40	7.25	3.85	±0.25

Wave Soldering (unit:mm)

Size	A	B	C	D	E	F	G	Placement Accuracy	Processing Number & Dimensions of dummy tracks
0603	2.70	0.90	0.90	0.80	0.15	3.40	1.90	±0.25	1×(0.15×0.80)
0805	3.40	1.30	1.05	1.30	0.20	4.30	2.70	±0.25	1×(0.20×1.30)
1206	4.80	2.30	1.25	1.70	1.25	5.90	3.20	±0.25	3×(0.25×1.70)
1210	4.80	2.30	1.25	2.50	1.25	5.90	3.60	±0.25	3×(0.25×1.70)
1218	4.80	2.30	1.25	4.80	1.30	5.90	5.60	±0.25	3×(0.25×4.80)
2010	6.30	3.50	1.40	2.50	3.00	7.00	3.60	±0.25	3×(0.75×2.50)
2512	8.50	4.50	2.00	3.20	3.00	9.00	4.30	±0.25	3×(1.00×3.20)

8. Reliability Performance

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, sub-clause 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).

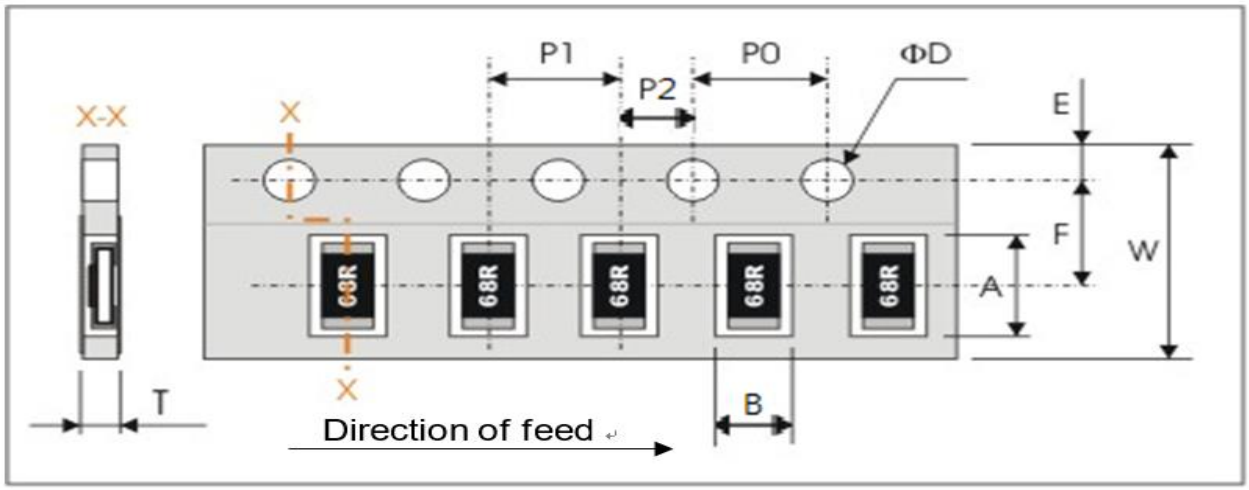
All soldering tests are performed with midly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
Electrical Characteristics **JISC5201-1: 1998** Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2-R_1}{R_1(t_2-t_1)}\times 10^6$ (ppm/°C) t_1 : 20°C+5°C-1°C R_1 : Resistance at reference temperature R_2 : Resistance at test temperature	Within the specified tolerance Refer to “ 5.Rating DATA”	
Resistance to soldering heat (R.S.H) **MIL-STD-202** **method 210**	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270℃±5°C	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
Solderability **J-STD-002**	a) Bake the sample for 155℃ dwell time 4hrs/ solder dipping 235℃/ 5sec. b) Steam the sample dwell time 1 hour/ solder dipping 215 ℃/5sec. c) Steam the sample dwell time 1 hour/ solder dipping 260 ℃/ 7sec.	95% coverage min., good tinning No visible damage	
Temperature cycling **JESD22** **method JA-104**	1000 cycles, -55℃ ~ +155℃, dwell time 5~10min	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	**0Ω**
Moisture Resistance **MIL-STD-202** **method 106**	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
Bias Humidity **MIL-STD-202** **method 103**	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Operational Life **MIL-STD-202** **method 108**	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
High Temperature Exposure **MIL-STD-202** **method 108**	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
Mechanical Shock **MIL-STD-202** **method 213**	1/2 Sine Pulse / 1500g Peak / Velocity 15.4ft/sec	Within the specified tolerance No visible damage	<50mΩ
Board Flex **AEC-Q200-005**	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 2mm for 10sec	ΔR/R max. ±(1.0%+0.05Ω). No visible damage	<50mΩ
Terminal strength **AEC-Q200-006**	Pressurizing force: 1Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations	
Vibration **MIL-STD-202** **method 204**	Test 5g's for 20min., 12 cycles each of 3 orientations	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Thermal shock **MIL-STD-202** **method 107**	Test –55 to 155℃/ dwell time 15min/ Max transfer time 20sec 300cycles	ΔR/R max. ±(0.5%+0.05Ω) No visible damage	<50mΩ
ESD **AEC-Q200-002**	Test contact 1.0KV (0.5KV for 0402 only)	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ
Short Time Overload (STOL) **JISC5201-1: 1998** **Clause 4.13**	5×Rated power or Max. Overload voltage for 5 sec. Measure the resistance after 30 minutes.	no visible damage ΔR/R max. ±(1%+0.05Ω)	<50mΩ
Sulfuration test	1. Oil 105'C soaked with 3.5% sulphur , 500hrs 2. ASTM B-809 105'C 1000hrs	ΔR/R max. ±(1.0%+0.05Ω) No visible damage	<50mΩ

9. PACKAGING

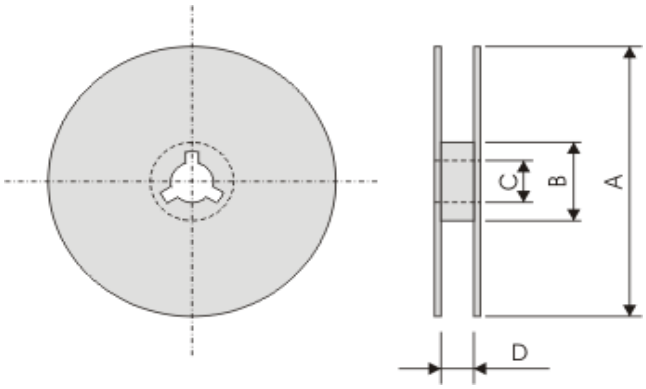
9.1 Tape Packaging Dimensions (unit.mm)



Series No.	A	B	W	F	E
FPF25	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
FPF12	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
FPF06	3.60±0.20	2.00±0.20			
FPF08	2.40±0.20	1.65±0.20			
FPF03	1.90±0.20	1.10±0.20			
FPF02	1.20±0.10	0.70±0.10			

Series No.	P1	P0	P2	ΦD	T
FPF25	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.2
FPF 12/06/08					Max. 1.0
FPF03					0.65±0.05
FPF02	2.00±0.10				0.40±0.05

9.2 Reel Dimensions (unit.mm)



Tape	Reel	A	B	C	D
12 mm plastic tape	7” reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	12.4.0±1.0
	10” reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	14.0±0.2
	13” reel	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	14.0±0.2
8 mm paper tape	7” reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
	10” reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
	13” reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5

10. Storage &. Handling

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 oxdization 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

Precaution for use ：

The AEC-Q200 series resistors is mainly used on general automotive equipment without safety considerations. Please contact our company in advanced if you intend to use resistor for designing the equipment which may damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising process and obtaining fully safety evaluation. The contents of the acknowledgment is only used for our parent company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the other nonofficial channels.

※ All product specification and data are subject to change without notice.

PDC