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SPECIFICATION FOR APPROVAL

DATE：

CUSTOMER：

PART NAME： Metal Paste Low Ohm Current Sense Chip Resistor

CUSTOMER'S DWG. NO.：

CUSTOMER'S PART NO.：

PDC PART NO.： **FBF ≧1Ω SERIES APPROVED**

DESCRIPTION.：

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PASSIVE SYSTEM ALLIANCE
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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

PDC

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FBF series. (Metal Paste)
Current Sensing Resistors ≧1Ω
Thick-film Chip Resistors AEC-Q200 qualified

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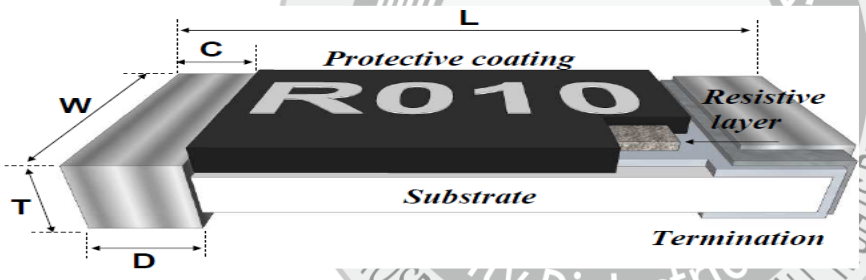
1. Features

- Low TCR and high precision
- Excellent reliability and suitable cost
- Suitable for lead free soldering
- RoHS compliant & Halogen Free
- Totally lead (Pb) free &. RoHS exemption free

2. Applications

- Consumer electronics, M/B
- Battery pack, BTC
- Notebook, Tablet PC
- Portable Device, Electronic Equipment

3. Dimensions and Constructions



Unit：mm

Type.	L	W	C	D	T
FBF06	3.10±0.10	1.60±0.10	0.50±0.25	0.50±0.25	0.55±0.10
FBF20	5.00±0.20	2.50±0.20	0.60±0.25	0.60±0.25	0.60±0.10
FBF25	6.30±0.20	3.10±0.20	0.60±0.25	0.90±0.25	0.60±0.15

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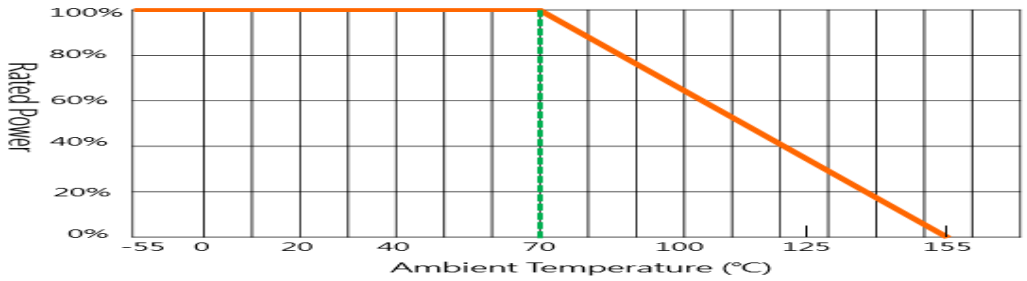
4. Power Derating Curve

Operating Temperature Range: -55 to +155℃



5. Rating

Normal Type		Power Rating at 70℃	Max. RCWV (V)	Max. Overload (V)	Tolerance (%)	TCR (ppm/℃)	Resistance (Ω)		Standard Resistance Values
Type	Size						Min. ~	Max.	
FBF06	1206	1/4W	1.58	3.54	±1 ±2 ±5	±100	1	10	E-24 &. E-96
FBF20	2010	3/4W	2.74	6.12	±1 ±2 ±5	±100	1	10	E-24 &. E-96
FBF25	2512	1W	3.16	7.07	±1 ±2 ±5	±100	1	10	E-24 &. E-96

Power Type		Power Rating at 70℃	Max. RCWV (V)	Max. Overload (V)	Tolerance (%)	TCR (ppm/℃)	Resistance (Ω)		Standard Resistance Values
Type	Size						Min. ~	Max.	
FBF06	1206	1/2W	2.24	5.00	±1 ±2 ±5	±100	1	10	E-24 &. E-96
FBF20	2010	1W	3.16	7.07	±1 ±2 ±5	±100	1	10	E-24 &. E-96
FBF25	2512	2W	4.47	10.00	±1 ±2 ±5	±100	1	10	E-24 &. E-96

Notes:

1. RCWV is Rated 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. Before use low ohm resistors, please consider the resistance variance from soldering pad/trace/amount, and keep the surface temperature do not exceed 105℃ when working.

6. Part Number

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Type	Size	Tolerance	Packing	Watt	R Codes	TCR	Grade Code
FBF	**06** 1206 **20** 2010 **25** 2512	**F** ±1% **G** ±2% **J** ±5%	Paper Tape 1206 **T** : 5Kpcs **V** : 10Kpcs **W** : 20Kpcs Plastic Tape 2010.2512 **P** : 4Kpcs **X** : 8Kpcs **Y** : 16Kpcs	**-** Normal type **P** Power type	**XXXX** ±1% 4 digits ±2 or 5% 3 digits	**N**: 100	"Null": Standard **M**: AEC-Q200 **MD**: AEC-Q200 Qualified Anti-sulfur

※ Sulfur resistant criteria(Code MD) : EIA-977.105°C.750H Compliable. △R≦±3%.

Example：

FBF06FT-3R00N

➔1206, tolerance 1%, paper tape, normal, 3Ω, 100ppm, standard.

FBF25JPP6R8 NM

➔2512, tolerance 5%, plastic tape, power, 6.8Ω, 100ppm, AEC-Q200.

FBF20FPP10R0NMD

➔2010, tolerance 1%, plastic tape, power, 10Ω, 100ppm, AEC-Q200, Anti-Sulfur.

7. Marking/Soldering

Resistance value identify：

E24 ±2% or 5% (3 digits marking to identify the R value)



1R0 → 1R x 10^{0} = 1 Ω

E24/E96 ±1% (4 digits marking to identify the R value)



3R90 → 3R9 x 10^{0} = 3.9 Ω

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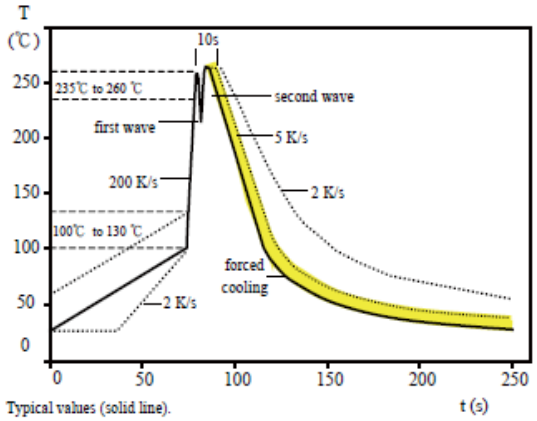
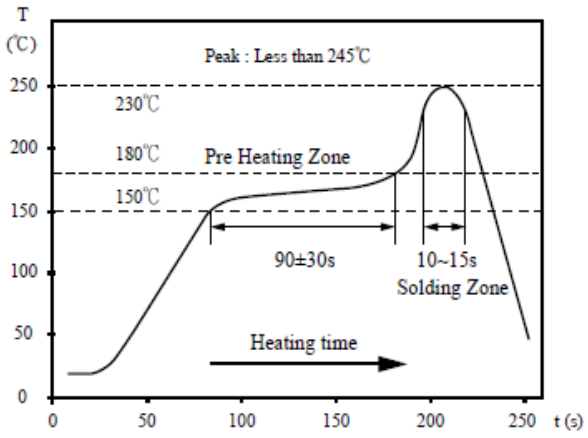
Soldering Reference：Compatible for most industrial soldering request.

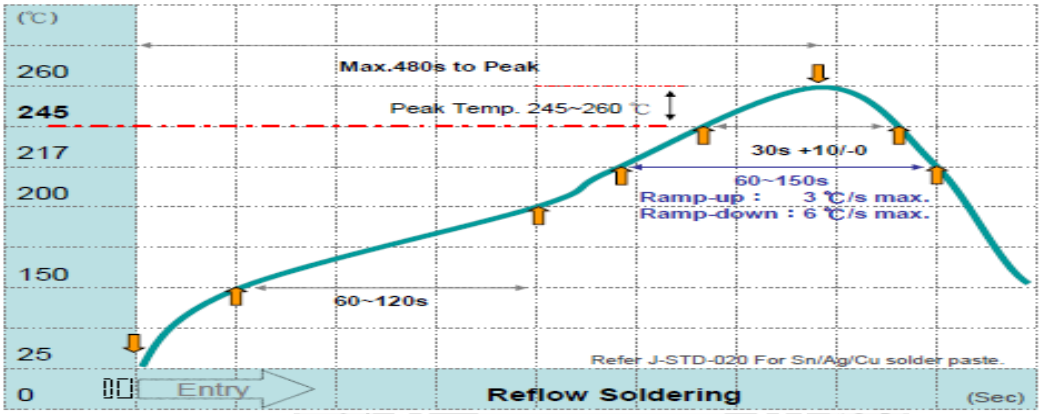


Typical values (solid line).
Process limits (dotted line).

WAVE soldering.

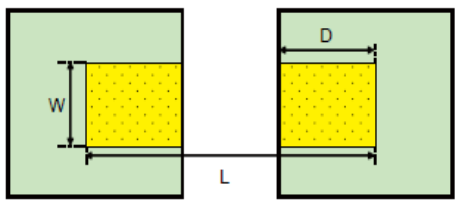


IR Reflow soldering.



Recommend Solder Pad Dimensions：

Type	W	D	L
FBF06	1.80	1.30	4.70
FBF20	3.00	1.50	6.80
FBF25	3.70	1.60	7.60



Unit. mm

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8. Reliability Performance

8.1 AEC-Q200 Grade

Test	Specification	Test Methods (AEC-Q200)
DC Resistance	F：± 1%　G：±2% J：±5%	**AEC-Q200 TABLE 7.1** **IEC 60115-1 / JIS C 5201-1 , Clause 4.5** Measure the resistance Value.
High Temperature Exposure (Storage)	△R≦±(3%+0.5mΩ) F：△R≦±(1%+0.5mΩ)	**AEC-Q200 TABLE 7.3** 1000 hrs. @ T=155℃. Unpowered. Measurement at 24 ±2 hours after test conclusion.
Temperature Cycling	△R≦±(1%＋0.5mΩ) F：△R≦±(0.5%＋0.5mΩ) No mechanical damage.	**AEC-Q200 TABLE 7.4** 1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion.
Moisture Resistance	△R≦±(1%+0.5mΩ) F：△R≦±(0.5%+0.5mΩ)	**AEC-Q200 TABLE 7.6** Test 65°C/80~100%RH/10Cycles. Measurement at 24±2 hours after test conclusion. (t=24hrs/cycle).
Biased Humidity	△R≦±(3%+0.5mΩ) F：△R≦±(1%+0.5mΩ)	**AEC-Q200 TABLE 7.7** 1000 hours 85°C/85%RH. 10% of operating power. Measurement at 24 ±2 hours after test conclusion.
Operational Life	△R≦±(3%+0.5mΩ) F：△R≦±(1%+0.5mΩ)	**AEC-Q200 TABLE 7.8** Test 1000hr @ TA=125℃ at specified rated power. Measurement at 24±2 hours after test conclusion.
External Visual	No visual damage and refer PDC marking code.	**AEC-Q200 TABLE 7.9** Inspect device construction, marking and workmanship.
Physical Dimension	Within the spec.	**AEC-Q200 TABLE 7.10** Verify physical dimensions to the applicable device detail specification.
Mechanical Shock	Within product specification tolerance and no visible damage.	**AEC-Q200 TABLE 7.13** Test Peak value:100g's,Wave:Half-sine, Duration:6ms,Velocity:12.3ft/sec.
Vibration	No mechanical damage.	**AEC-Q200 TABLE 7.14** 5 g's for 20 min., 12 cycles each of 3 orientations. Test from 10-2000 Hz.

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Resistance to Solder Heat	ΔR≦±(1%＋0.5mΩ) F：ΔR≦±(0.5%＋0.5mΩ) No mechanical damage.	**AEC-Q200 TABLE 7.15** Solder dipping @ 270℃±5℃ for 10sec.±1sec.
Thermal Shock	ΔR≦±(1%＋0.5mΩ) F：ΔR≦±(0.5%＋0.5mΩ) No mechanical damage.	**AEC-Q200 TABLE 7.16** -55 to 155℃/ dwell time 15min/ Max transfer time 20sec/ 300cycles.
ESD	ΔR≦±(1%＋0.5mΩ) No mechanical damage.	**AEC-Q200-002** Test contact min. 1KV.
Solder Ability	Over 95% of termination must be covered with solder.	**AEC-Q200 TABLE 7.18** a)Baking 155℃ 4H, dipping 235℃ 5s b)Steam 8H, dipping 215℃ 5s c)Steam 8H, dipping 260℃ 7s
Flammability	Refer UL-94.	**AEC-Q200 TABLE 7.20** UL-94 V-0 or V-1 are acceptable
Board Flex	ΔR≦±(1%＋0.5mΩ) F：ΔR≦±(0.5%＋0.5mΩ) No mechanical damage.	**AEC-Q200 TABLE 7.21** Bending 2mm 2512.2010.1210.1206
Terminal Strength	No mechanical damage	**AEC-Q200 TABLE 7.22** Force 1.8 Kg for 60 seconds.
Electrical	**Specification**	**Test Methods (IEC 60115)**
Short Time Overload	ΔR≦ ±(2%＋0.5mΩ) F：ΔR≦ ±(1%＋0.5mΩ)	**IEC 60115-1, Clause 4.13** 5 × Rated power for 5 seconds
Temperature Coefficient of Resistance	TCR within the spec. (ppm/℃)	**IEC 60115-1, Clause 4.8** Test temperature：(T1)25℃~(T2)+155℃ TCR(ppm/℃) = $(R_2-R_1)/R_1\times1 / (T_2-T_1)\times10^6$
Environmental	**Specification**	**Test Methods (EIA-977)**
Anti-Sulfur	ΔR≦ ±(3%+0.5mΩ)	**EIA-977(Test B)** Sulfur 750 hours, 105±2°C

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8.2 Standard Grade

Test	Specification	Test Methods
DC Resistance	F：±1%　G：±2% J：±5%	**IEC 60115-1 / JIS C 5201-1 , Clause 4.5** Measure the resistance Value.
Resistance to Solder Heat	ΔR≦ ±(1%＋0.5mΩ) F：ΔR≦±(0.5%＋0.5mΩ) No mechanical damage	**IEC 60115-1, Clause 4.18** Solder dipping @ 260℃±5℃ for 10sec.±1sec.
Solder Ability	Over 95% of termination must be covered with Solder.	**IEC 60115-1, Clause 4.17** After immersing flux, dip in the 245±2℃ molten solder bath for 3±0.5 sec.
Short Time Overload	ΔR≦ ±(2%＋0.5mΩ) F：ΔR≦±(1%＋0.5mΩ)	**IEC 60115-1, Clause 4.13** 5 × Rated power for 5 seconds
Temperature Coefficient of Resistance	TCR within the spec. (ppm/℃)	**IEC 60115-1, Clause 4.8** Test temperature：(T1)25℃~(T2)+155℃ TCR(ppm/℃) = $(R_2-R_1)/R_1 \times 1 / (T_2-T_1) \times 10^6$
Load Life	ΔR≦ ±(3%＋0.5mΩ) F：ΔR≦±(1%＋0.5mΩ)	**IEC 60115-1, Clause 4.25** Rated voltage for 1.5 hours for followed by a pause 0.5 hour at 70±2℃.Cycle repeated 1000 hours.
Bending Strength	ΔR≦ ±(1%＋0.5mΩ) F：ΔR≦±(0.5%＋0.5mΩ) No mechanical damage	**IEC 60115-1, Clause 4.33** Resistance variance after bended on 90mm PCB. 2mm 2512.2010.1206
Insulation Resistance	Between termination and coating must over 1000MΩ	**IEC 60115-1, Clause 4.6** Test voltage：100±15V

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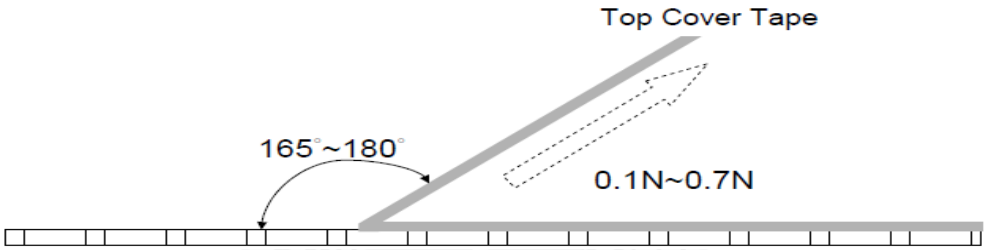
9. PACKAGING

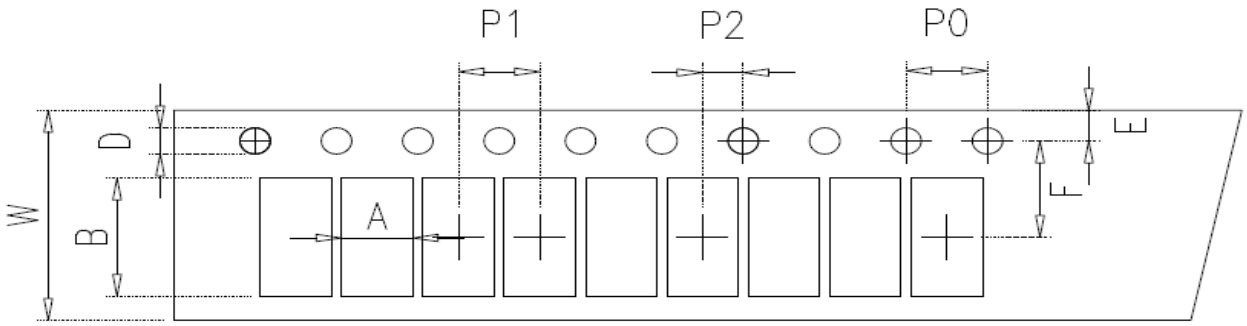
9.1 Peel Strength of Top Cover Tape

The peel speed shall be about 300 mm/min

The peel force of top cover tape shall between 0.1 to 0.7N



9.2 Tape Packaging Dimensions



unit:mm

Size	A	B	W	F	E	P1	P2	P0	D
1206	2.00±0.20	3.60±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
2010	2.80±0.20	5.50±0.20	12.00±0.30	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
2512	3.50±0.20	6.70±0.20	12.00±0.30	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0

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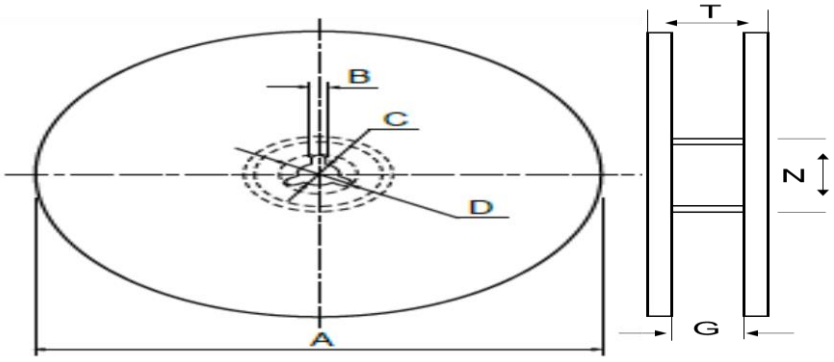
9.3 Reel Dimensions



unit:mm

Size	Packaging Q'ty	A	N	C	D	B	G	T
1206	5kpcs/Reel	178.0±2.0	60.0±0.5	13.0±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
	10kpcs/Reel	254.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
	20kpcs/Reel	330.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
2010 2512	4kpcs/Reel	178.0±2.0	60.0±0.5	13.0±0.5	20(Min.)	2.0±0.5	13.8±1.5	16.7max.
	8kpcs/Reel	254.0±2.0	100.0±0.5	13.5±0.5	20(Min.)	2.0±0.5	13.8±1.5	20.0max.
	16kpcs/Reel	330.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	13.8±1.5	20.0max.

10. Storage &. Handling

… Products are recommended to be used up within one year as ensured shelf life.
Check solder ability in case shelf life extension is needed.

… To store products with following condition:
Temperature:5 to 40℃；Humidity: 20 to 70% relative humidity.

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.

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