FOSAN TECHNOLOGY 富捷科技

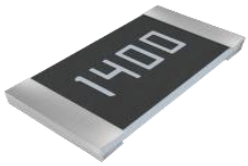
Product Datasheet
产品规格说明书

FQS Series Anti-Surge Automotive Thick Film Chip Resistor

车规抗浪涌厚膜片式电阻器

安徽省富捷电子科技有限公司
ANHUI FOJAN ELECTRONICS TECHNOLOGY CO., LTD
安徽省马鞍山市郑蒲港新区金蒲电子产业园
JINPU ELECTRONIC INDUSTRIAL PARK, ZHENGPU PORT NEW DISTRICT, MAANSHAN CITY, ANHUI PROVINCE
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抗浪涌车规厚膜片式电阻器
Anti-Surge Automotive Thick Film Chip Resistor FQS Series



特点 (Features)

- 电性能稳定，可靠度高 - Stable electrical capability and high Reliability
- 符合 RoHS 指令和无卤素要求 - Compliant with RoHS directive and Halogen free requirement
- 具有优越的抗硫化性能 - With excellent Anti-sulfured performance
- 符合 汽车标准相关条款 -Compliant with AEC-Q200 standard
- 大幅提高抗浪涌能力 - Substantially increase the ability of anti-surge

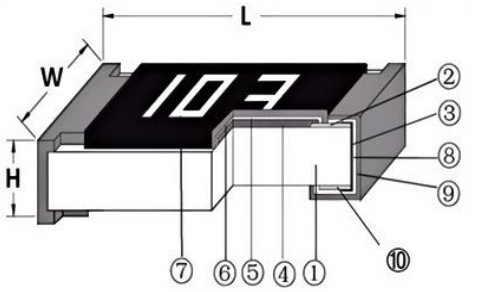
应用 (Application)

- 广泛应用于开关电源、音响设备的过电流保护、电压调节器、电源转换器、充电器、汽车引擎控制器、工业控制设备等。
- Widely used in Switching Power Supply Over Current Protection in Audio Application Voltage Regulation Module(VRM) DC-DC Converter Charger Automotive Engine Control ,Industrial control etc.

产品料号 (Parts Number Explanation) 示例: FQS1206F1001TS

F 公司	QS 产品别	1206 尺寸	F 公差	1001 字码	T 包装别	S 端电极	特殊码
FOJAN	**QS: Anti-Surge Automotive** Others series refer to Catalogue	0603 0805 1206 1210 1812 2010 2512	F:±1% G:±2% J:±5% K:±10% M:±20%	±5%:E24 3-digits+blank 102=1KΩ 1R0=1Ω ±1%: E96+E24: 4-digits 1001=1KΩ 1R00=1Ω	T: 7 inch reel Q:10 inch reel R:13 inch reel B:Bulk	S: Sn C: Cu A: Au	Blank: none
Company	Product Type	Size	Tolerance	Resistance	Packaging	Termination	Special Case

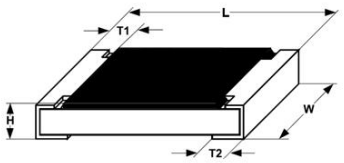
▪ 电阻结构 (Construction)



NO.	结构 Construction	主要材料 Major material
1	陶瓷基板 Ceramic substrate	三氧化二铝 Al_2O_3
2	导电层 Conductive layer (Top)	银/银钯 Ag/Ag-Pd
3	侧导层 Side conductive layer	镍铬合金 Ni-Cr
4	阻体层 Resistive layer	氧化钌 RuO_2
5	内保护层 Inner protective layer	玻璃 Glass
6	外保护层 Outer Protective layer	环氧树脂 Epoxy
7	文字 Marking	环氧树脂 Epoxy
8	镍电极 Ni plating layer	镍 Ni
9	锡电极 Sn plating layer	锡 Sn
10	导电层 Conductive layer (Back)	银 Ag

▪ 尺寸 (Dimension):

尺寸 Dimension



单位 (unit)： mm

型别 (Type)		L	W	H	T1	T2
英制	公制					
0603	1608	1.60±0.10	0.80±0.10	0.45±0.10	0.25±0.15	0.25±0.15
0805	2012	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20
1206	3216	3.10±0.10	1.60±0.10	0.55±0.10	0.45±0.20	0.45±0.20
1210	3225	3.10±0.10	2.50±0.15	0.55±0.10	0.45±0.15	0.50±0.20
1812	4532	4.50±0.20	3.10±0.20	0.55±0.10	0.55±0.20	0.70±0.20
2010	5025	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.15	0.50±0.20
2512	6432	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.20	0.90±0.20

■ 电气特性 (Electrical characteristics)

型别 Type	70°C 下额定功率 Rated Power at 70°C	最大工作电压 Max Working Voltage	最大过负荷电压 Max Overload Voltage	绝缘耐压 Dielectric Withstanding Voltage
0603	1/10W	75V	150V	300V
0805	1/8W	150V	300V	500V
1206	1/4W	200V	400V	500V
1210	1/2W	200V	400V	500V
1812	3/4W	200V	500V	500V
2010	3/4W	200V	400V	500V
2512	1W	200V	400V	500V

备注（Remark）： 额定电压计算公式（The rated voltage is calculated by the following formula）：

E= $\sqrt{RP}$

E：额定电压（Rated Voltage） (V)

P：额定功率（Rated Power ） (W)

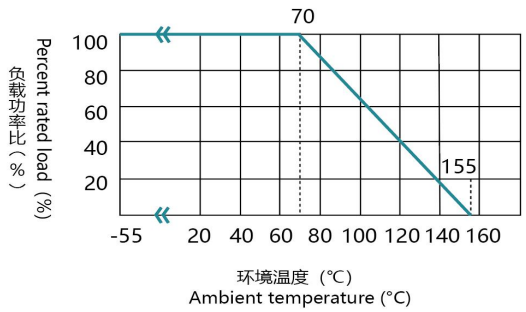
R：电阻阻值（Resistance ） (ohm)

如果计算出的电压超过此型别的最大工作电压，则此型别的最大工作电压为此电阻的额定电压。
In case the value calculated by the formula exceed the maximum working voltage as above table , the maximum working voltage shall be regarded as rated voltage.

■ 温度系数 (Temperature Coefficient)

型别 Type	阻值范围 Resistance Range	产品精度和温漂系数（ppm/°C） Resistance Tolerance and TCR(ppm/°C)		
		±1%	±2%	±5%
0603/0805 1206/1210 1812/2010/2512	1Ω≤R＜10Ω	±400	±400	±400
	10Ω≤R＜1MΩ	±100	±100	±100
	1MΩ≤R＜10MΩ	±100	±100	±100

■ 功率衰减曲线 (Derating Curve)

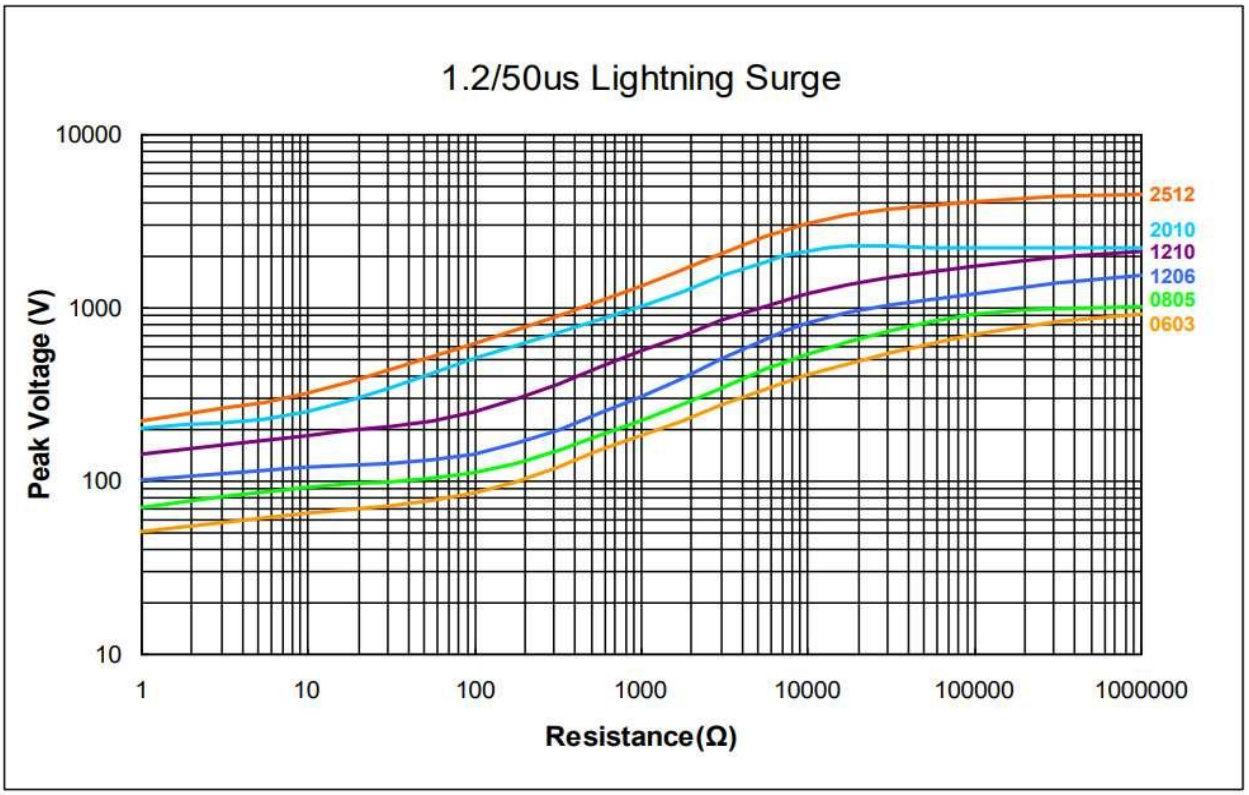
使用温度范围 Temperature usage range	-55℃~+155℃
说明 Describe	周围温度若超过 70℃至 155℃之间，功率可照下图曲线予以修订 If the ambient temperature exceeds 70°C to 155°C, the power can be revised according to the curve in the following figure
功率衰减曲线图 Power Attenuation Curve	

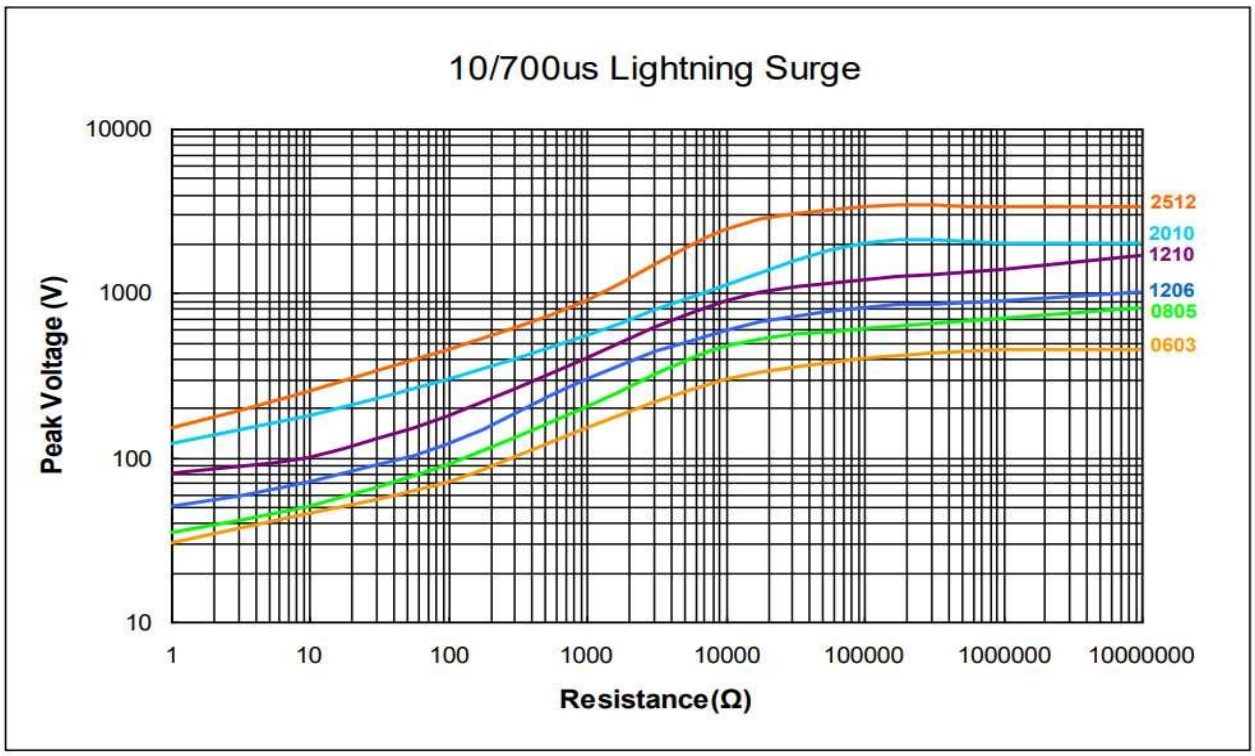
浪涌特性 (Surge Performance)

1.雷电浪涌（Lightning Surge)

雷电冲击电阻器根据 IEC 60115-1 使用 1.2/50us 和 10/700 脉冲形状进行测试，接受极限时电阻从初始值偏移小于 1%

Resistors are tested in accordance with IEC 60115-1 using both 1.2/50us and 10/700 pulse shapes.The limit of acceptance is a shift in resistance of less than 1% from the initial value

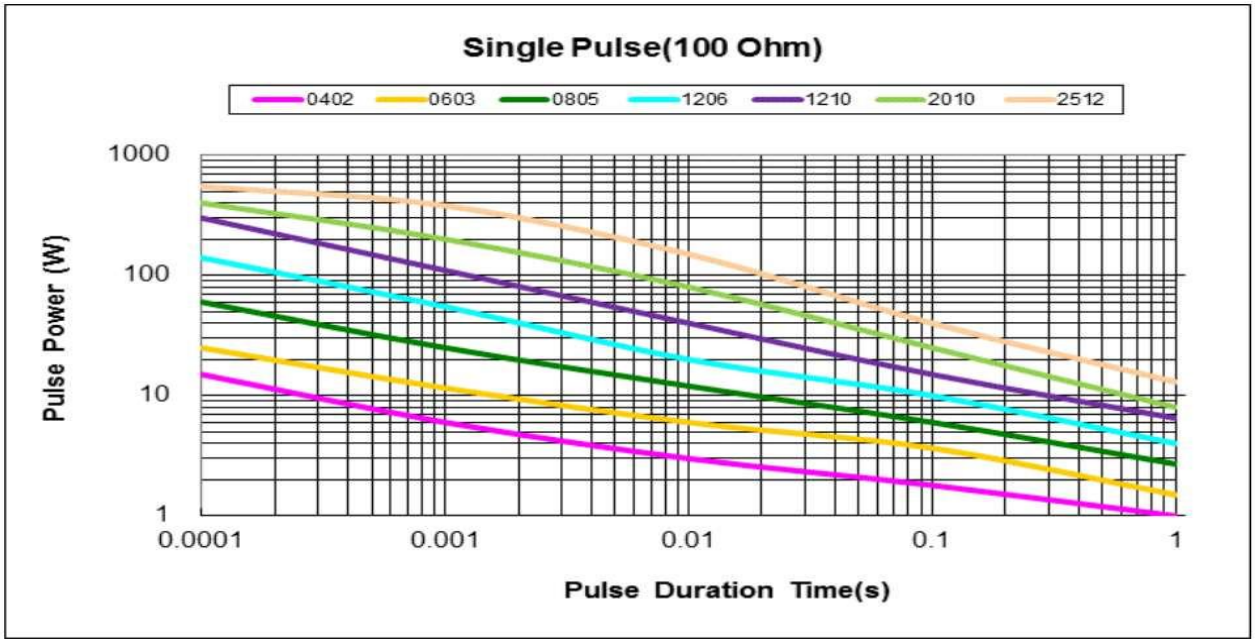




2.耐脉冲能力（Pulse withstanding capacity)

接受极限是电阻从初始值偏移不到 1%。施加的功率取决于所示最大允许冲击电压图的限制

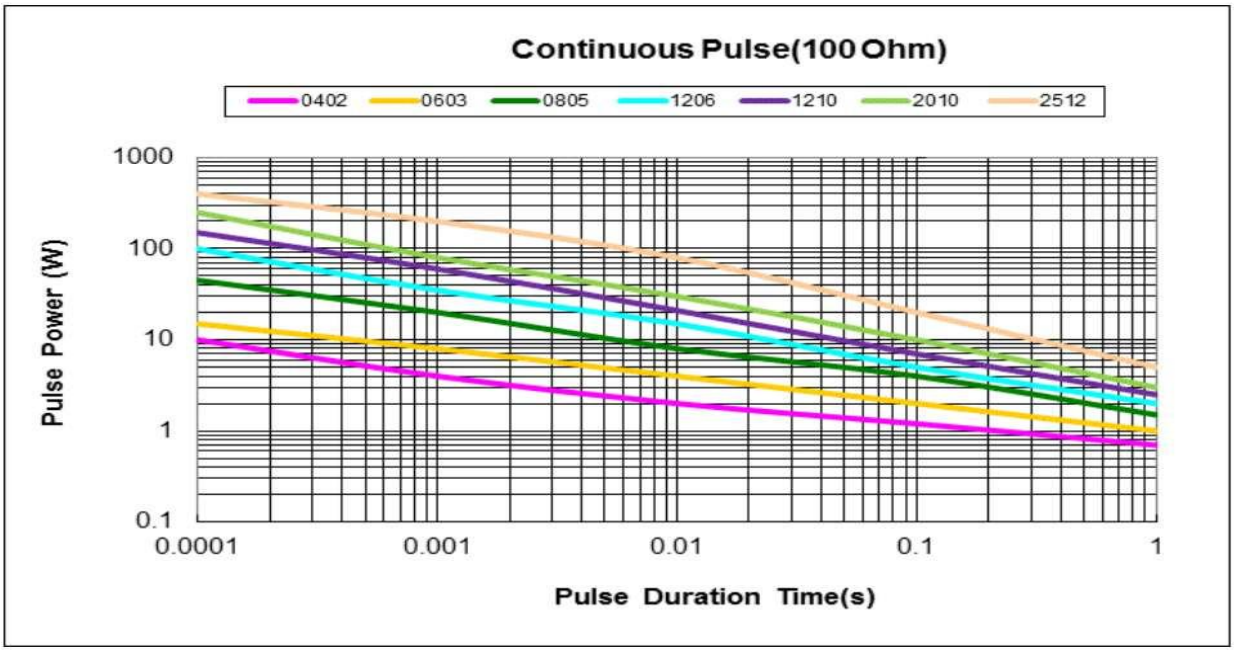
The limit of acceptance was a shift in resistance of less than 1% from the initial value. The power applied was subject to the restrictions of the maximum permissible impulse voltage graph shown

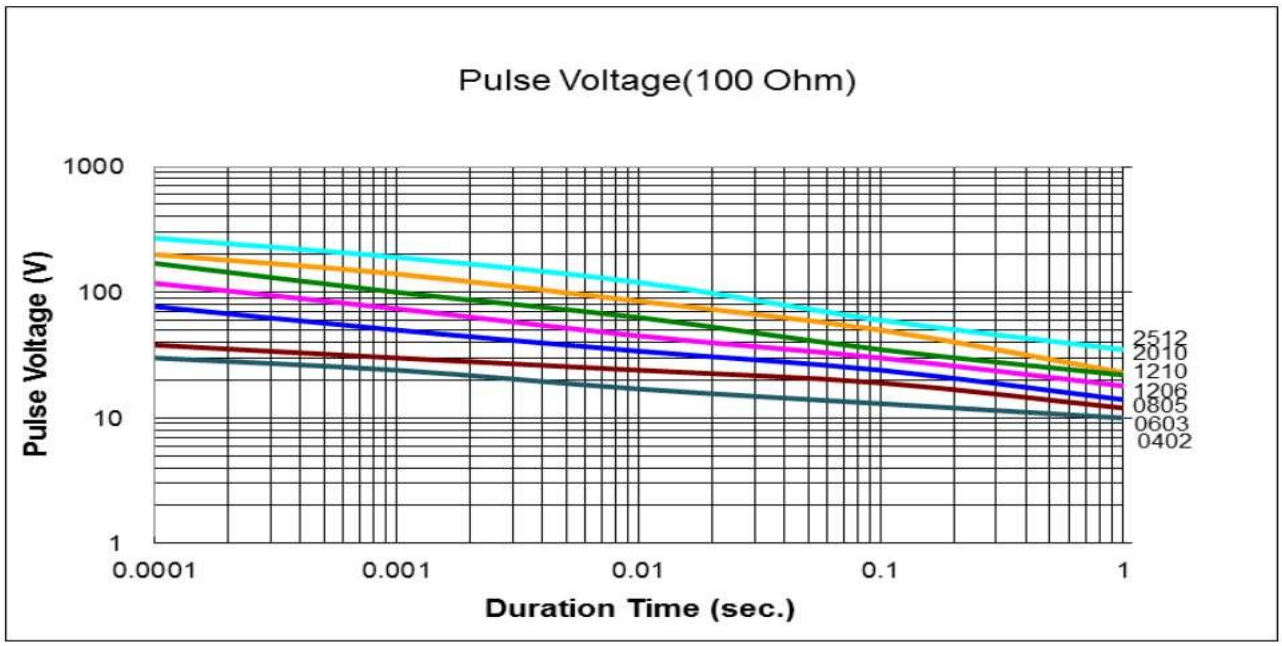


3.连续脉冲（Continuous Pulse)

通过施加重复的矩形脉冲来获得连续负载图，其中脉冲周期被调整为电阻器中消耗的平均功率等于 70℃时的额定功率电阻比初始值低 1%

The continuous load graph was obtained by applying repetitive rectangular pulses where the pulse period was adjusted so that the average power dissipated in the resistor was equal to its rated power at 70 C. Again the limit of acceptance was a shift in resistance of less than 1% from the initial value





■ 性能（Performance）

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
温度系数 Temperature Coefficient	JIS C 5201 4.8	TCR=（R-R_0）/（t-t_0）R_0 ×10^{6}(ppm) R0：电阻在室温下的阻值（resistance at room temperature) R: 电阻在 125℃或-55℃下的阻值（resistance at 125℃ or -55℃) t0：室温（room temperature) t.测试温度（test temperature 125℃ or -55℃)	As SEPC
短时间过负荷 Short-time overload	JIS C 5201 4.13	加载 5 倍的额定功率，时间 5 秒后测量试验前后的阻值变化率。 Applied 5 times of rated power for 5 second. Measure the variation of resistance.	1%:±(1.0%+0.05Ω) 2%、5%:±(2.0%+0.05Ω)
高温储存 High Temperature Exposure	AEC-Q200 TEST 3 MIL-STD-202 METHOD 108	125℃下放置 1000h，不加载功率，试验结束 24±4 小时后进行测 试。 1000 hrs. @ T=155 . Unpowered.Measurement at 24±4 hours ℃ after test conclusion	±(1.00%+0.05Ω)
温度循环 Temperature Cycling	AEC-Q200 TEST 4 JESD22 METHOD JA-104	-55 ~+ 155，℃ ℃ 循环 1000 次，在每一个极限温度持续时间不超过 30 分钟，且温度转换时间不超过 1 分钟，试验结束 24±4 小时后进行测试。 1000 Cycles (-55 to +155) Measurement at 24±4 hours ℃ ℃ after test conclusion. 30min maximum dwell time at each temperature extreme. 1min. maximum transition time.	±(2.00% +0.05Ω)

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
温湿循环 Moisture resistance	MIL-STD-202 METHOD 106	25°C~65°C,90%～100%RH, 2.5 小时； 65°C 90%～100%RH, 3 小时； 65°C~25°C,80%～100%RH,2.5 小时，10 个循环，试验结束 24±4 小时后进行测试。 25°C~65°C,90%～100%RH, 2.5H; 65°C 90%～100%RH, 3H; 65°C~25°C 80%～100%RH, 2.5H, 10 cycles, Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 2%、5%:±(2.0%+0.05Ω)
耐湿特性 Humidity	MIL-STD-202 METHOD 103 AEC-Q200 TEST 7	电阻放入恒温恒湿箱，加载 10%额定功率，85℃/85%RH，持续通电 $1000^{+24}/_{-0}$H，试验结束 24±4 小时后进行测试 Put the specimen in a chamber Load 10% of operating power,1000 hours 85℃/85%RH. Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 2%、5%:±(2.0%+0.05Ω)
负荷寿命 Load life	MIL-STD-202 METHOD 108 AEC-Q200 TEST 8	电阻放入恒温箱中，温度 125±2℃，加载 45%额定功率 ON TIME:1.5H，OFF TIME:0.5H，通电 1000 $^{+24}/_{-0}$H，试验结束 24±4 小时后进行测试 Put the specimen in a chamber at 125±2℃ temperature, Load 45% rated power ON TIME:1.5H, OFF TIME:0.5H, and applied for 1000 $^{+24}/_{-0}$H.Measurement at 24±4 hours after test conclusion.	1%:±(1.0%+0.05Ω) 2%、5%:±(2.0%+0.05Ω)
焊锡性 Solderability	AEC-Q200 TEST 18 J-STD-002	用于引脚型和表面贴装型元件，不需要电气测试。 放大倍数 50 倍。 测试条件： 表面贴装型： a）方法 B，干热@155℃,4 小时，@235℃,3±0.5 秒 b）方法 B，蒸煮 8 小时， @235℃,3±0.5 秒 For pin and surface-mount components, no electrical testing required. Magnification 50 times.Test conditions: Surface mount type: a) Method B: dry heat @155℃,4 hours, @235℃,3±0.5 seconds b) Method B: cook for 8 hours at @235℃,3±0.5 seconds	上锡面积＞95% (Solderedare >95%)
抗焊锡热 Resist to soldering heat	AEC-Q200 TEST 15 MIL-STD-202 METHOD 210	沾助焊剂后浸入锡炉，锡炉温度 260±5℃，时间 10±0.5 秒， 测量试验前后的阻值变化率。 Dip the terminal in a flux and then dip into a soldering bath at 260±5℃ for 10±0.5sec. Measure the variation of resistance.	±(1.00% +0.05Ω)
绝缘电阻 Insulation resistance	JIS C 5201 4.6 IEC60115-1-4.6	电阻本体上加载绝缘耐压 60±5 秒，测量绝缘阻抗。 Applied the dielectric withstanding voltage on the center of body for 60±5seconds. Then measure insulation resistance.	>10GΩ
绝缘耐压 Dielectric withstanding voltage	JIS C 5201 4.7 IEC60115-1-4.7	电阻本体上加载绝缘耐压 60±5 秒。 Applied the dielectric withstanding voltage on the center of body for60±5seconds.	无击穿、飞弧可见机械性损伤 No evidence of flash over, mechanical damage arcing or insulation breakdown

内容 Item	测试方法 Test Methods	测试条件 Test Conditions	规格 Specification
端子强度 Terminal Strength	AEC-Q200 TEST 11 MIL-STD 202 METHOD 211	04020.5kgf；0603:1.0kgf；其他规格：2.0kgf 施加推力，维持 60±1 秒 0402:0.5kgf, 0603:1.0kgf; Other:2.0kgf ;60±1 seconds;	无破损 No Broken
ESD 试验 ESD test	AEC-Q200 TEST 17 AEC-Q200-002	加载规定静电电压 2 次/间隔 1 秒， 0402 规格：0.5KV, 0603 规格：1KV, 其他规格 2KV. 0402: 0.5KV, 0603: 1.0KV, Other:2KV, 2times/1s	±(3.0%+0.05Ω)
端子弯曲 Terminal bending	AEC-Q200 TEST 21 AEC-Q200-005	电阻焊接在测试板上进行弯折，弯折保持时间 20±1 秒，1206（含） 以下的尺寸弯曲 5+0.2/0 mm; 1206 以上的尺寸弯曲 2+0.2/0 mm; 量测试验前后阻值变化率 Specimen shall be mounted on test board, then bend the board and maintained for 20±1s. the distance of bending is 5+0.2/0 mm for resistors which size no larger than 1206 or 2+0.2/0 mm which size larger than 1206. Measure the variation of resistance.	±(1.00% +0.05Ω)
耐溶剂性 Resistance to Solvents	AEC-Q200 TEST 12 MIL-STD 202 METHOD 215	注意：添加水性洗涤化学品-OKEM Clean 或等效物。请勿使用违 禁溶剂 Note: Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.	标识无脱落、损伤 No Marking fall off and broken
抗硫化实验 Sulfuration test	ASTM-B-809-95	方法一：温度 105℃，湿热蒸硫粉试验（加饱和硝酸钾）750hrs Method 1: steam sulfur powder test (with saturated potassium nitrate) at 105℃ with humidity and heat (750hrs)	±(3.0% +0.05Ω) Max

■ 本体标识 (Marking on the Resistor's Body)

1.公差±5%的产品，以三字码标示，前两位表示阻值的有效数字，最后一位表示 10 的乘幂
±5% tolerance product: the marking is 3 digits, the first 2 digits are significant figures of resistance value and the 3rd one denotes the power number of 10, (10X)

2.±0.5%，±1%，±2%的产品，以四字码标示，前三 位表示阻值的有效数字，最后一位表示 10 的乘幂
±0.5%, ±1%,±2% tolerance product: the marking is 4 digits, the first 3 digits are significant figures of resistance value and the 4th one denotes the power number of 10, (10X)

3.0603 ±1% E96 系列的标准阻值，因电阻本体太小，采用三位代码标识。
Standard E96 series values of 0603 ±1%: due to the small size of the resistor’ s body, use 3digits code to indicate the resistance value.



472=47×10²=4.7KΩ



10Ω以下标示：5R6=5.6Ω
Below 10Ω: 5R6=5.6Ω



4992=499×10²=49.9KΩ



100Ω以下标示
6R81=6.81Ω
Below 100Ω: 6R81=6.81Ω

▪ 0603±1% E96 系列电阻值代码 Standard E96 Series Resistance Value Code for 0603 ±1% Marking

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

▪0603±1%标记的倍增码 Multiplier Code for 0603 ±1% Marking

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

阻值标示如下（So the resistance value are marked as the following examples)



10D=124×10^{3}=124KΩ



38Y=243×10^{-2}=2.43Ω

0603 ±1%的产品，在标准 E24 系列中，但不属于 E96 系列，标示与 5%的字码相同，但是在中间字码下加一条线（Standard E24 and not belong to E96 series values of 0603 ±1%, the marking is the same as 5% tolerance but marking as underline)



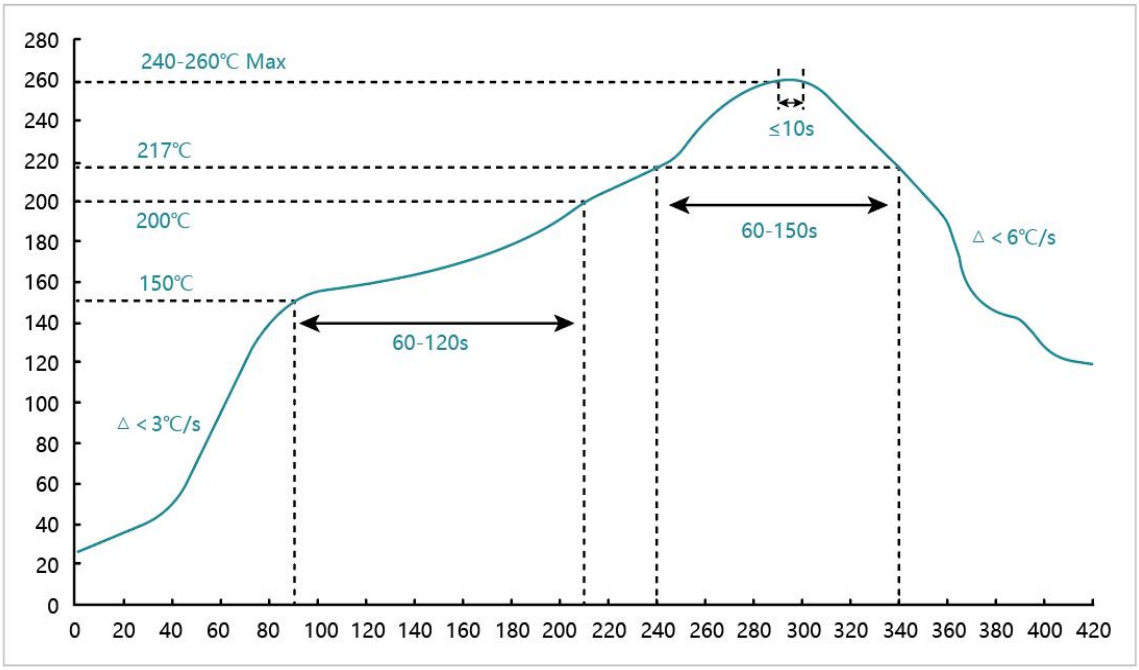
331=33×10^{1}=330Ω



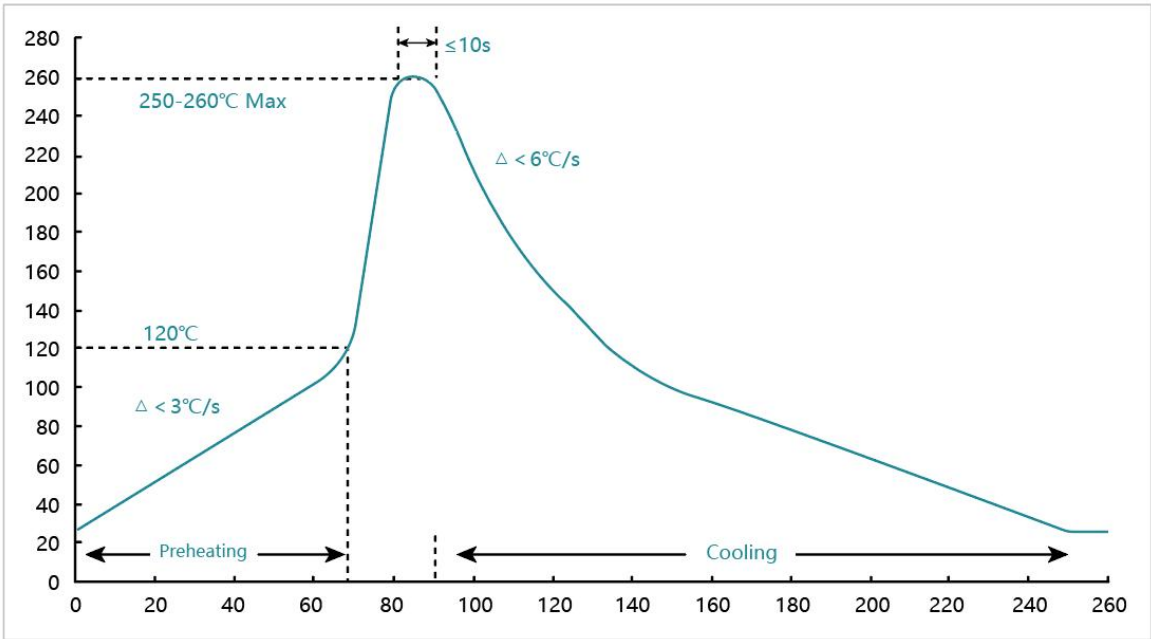
560=56×10^{0}=56Ω

■ 焊接 (soldering)

- 建议回流焊曲线（Recommend reflow soldering profile)



- 建议波峰焊曲线（Recommend wave soldering profile)



- 手工焊温度（hand soldering temperature)

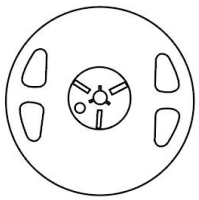
烙铁温度 350±10℃ 3 秒之内，避免烙铁接触电阻本体

The iron temperature is 350±10℃, hand soldering time less than 3S. Avoid solder iron tip direct touch the components body

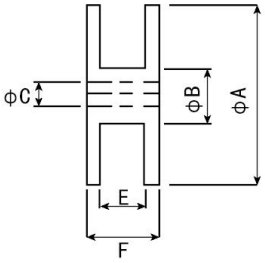
■ 包装规格（Tapping Specification）

- 卷盘尺寸（Reel dimension）

Reel



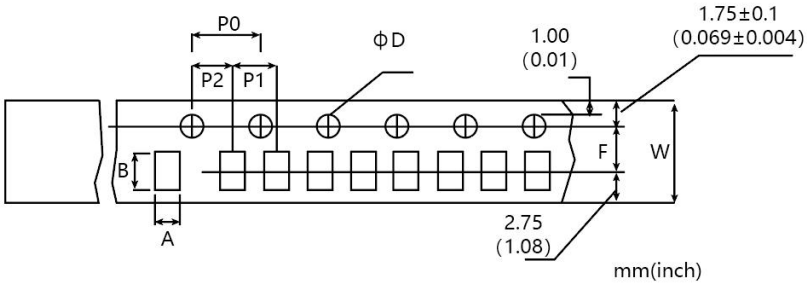
Standard Quantity per Reel
5000 pcs/Reel

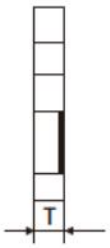


Type	Size		Unit	A	B	C	F	E
0603/0805/1206/1210	7″	5K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0603/0805/1206	10″	10K/Reel	mm	254±2.0	100.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
0603/0805/1206	13″	20K/Reel	mm	330±2.0	100.0±1.0	13.5±0.5	11.4±0.1	9.00±0.3
1812/2010/2512	7″	4K/Reel	mm	178±2.0	60.0±1.0	13.5±0.5	15.4±1.0	13.0±0.3

- 包装尺寸（packing dimension）

纸带编带 Paper Taping

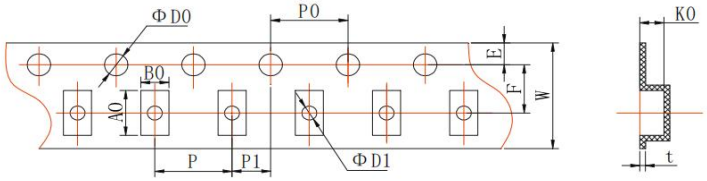




Unit: mm

Dim	A	B	D	F	P0	P1	P2	W	T
0603	1.10±0.10	1.90±0.10	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.60±0.03
0805	1.65±0.20	2.40±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.75±0.05
1206	1.90±0.20	3.50±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.75±0.05
1210	2.80±0.20	3.50±0.20	1.50±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	8.00±0.20	0.75±0.05

塑料带编带 Embossed Taping



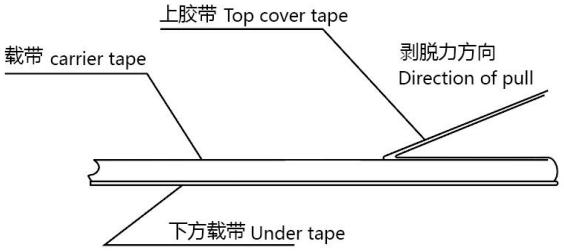
Unit: mm

Dim	B0	A0	D0	F	P0	P	P1	W	K0
1812	3.52±0.10	5.10±0.10	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10	0.78±0.10
2010	2.75±0.10	5.40±0.10	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10	0.75±0.10
2512	3.35±0.10	6.70±0.10	1.50±0.10	5.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	12.0±0.10	0.75±0.10

▪ 上胶带剥离力测试（Peel force of top cover tape）

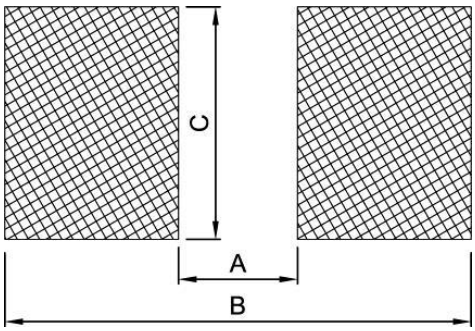
上胶带以 300mm/分钟的速度，沿 165∽180 度角的方向进行剥离，如下图所示。纸带的剥离力范围为 10g∽70g; 载带的剥离力范围 30∽100g。

The top cover tape is pulled at a speed of 300 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree as following picture. The peel force of paper carrier tape shall be 0.1N to 0.7N(10 to 70 g), the peel force of plastic carrier tape shall be 0.3N to 1N (30 to 100 g)



▪ 建议焊盘尺寸（Recommended Pad Dimensions）

Land pattern / Type	Dimensions（mm）		
	A	B	C
0603	0.80~1.10	2.00~2.50	0.80~1.00
0805	1.00~1.40	2.90~3.40	1.00~1.40
1206	2.00~2.40	4.10~4.60	1.50~1.80
1210	2.00~2.40	4.10~4.60	2.50~3.00
1812	2.80~3.30	5.00~6.00	3.00~3.50
2010	3.40~3.90	5.70~6.50	2.50~3.00
2512	3.60~4.20	7.60~8.60	3.00~3.50



▪ 厚膜电阻器使用说明（Chip Resistor Instructions for use）

本产品在以下特殊环境下应用，性能可能会受到影响：
(Application of the products in a special environment can deteriorate product performance)：

1. 高温；
   High temperature
2. 有海风或腐蚀性气体，包括氯气，硫化氢，氨气，二氧化硫，二氧化氮等；
   Near the sea ,or corrosive gas, such as Cl_2,H_2S,NH_3,SO_2,and NO_2,etc;
3. 各种类型的液体，包括水，油，化学品，有机溶剂的使用；
   Unverified liquids, such as water,oil,chenical or organic solvent;
4. 在用树脂或其他涂层材料密封产品的情况下使用；
   Unverified resin or paint to cover products;
5. 焊接后使用不洁焊剂或使用水或水溶性清洁剂清洗产品
   Products should be washed with soluble cheaner even if non cleaning flux.

- 储存 / 搬运条件（Storage / Carry conditions）

1. 储存温度 25±5℃　　Temperature：25±5℃
2. 湿度 30%～70%RH　　Humidity：30%～70%RH
3. 储存期限：先进先出，2 年　　Storage life：2years FIFO
4. 存放和搬运时，请保持盒子的正确方向。严禁跌落在箱体上，否则可能损坏产品电极或本体
   Please hold box correct orientation when storing and carrying.It is strictly prohibited to fall on the box. otherwise the product electrode or body may be damaged.

修订履历 (Revision History)

版本 Version	修订日期 Revision Date	修订内容 Revision Description	版本确认 Version Checked
FJ-JS-3001-V1.0	2020.12.01	原版 The original version	魏效振 Xiaozhen Wei
FJ-JS-3001-V2.0	2025.01.01	版本及格式修订 Version and format revision	魏效振 Xiaozhen Wei
FJ-JS-3001-V3.0	2026.09.05	1. 上胶带剥离力由 200 改为 300 2. 增加“建议焊盘尺寸”	青立旦 Lidan Qing