香港電阻

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香港柴湾安业街十二号长益工业大厦**10**字楼**A**座

HONG KONG RESISTORS MANUFACTORY

(wholly owned by Hong Kong Resistors Manufactory International Ltd.)

AN ISO 9001:2015 CERTIFIED MANUFACTURER

AN ISO 45001: 2018 MANUFACTURER

AN ISO 14001: 2015 MANUFACTURER

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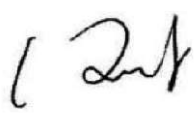
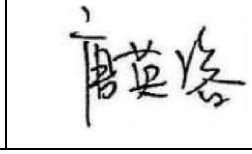
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DATASHEET

Name of Product: Automotive Grade High Power Chip Resistor - AFPF Series

Sales Executive:_____ Date: 2023/12/16

制造 Prepared by	品质 Quality by	业务 Sales by	核准 Authorized by
			
客户 customer approval	客户 customer approval	客户 customer approval	客户 customer approval

Spec. No. AFPF 2023

Rev. No.: 2023 Dec

Automotive Grade High Power Chip Resistor



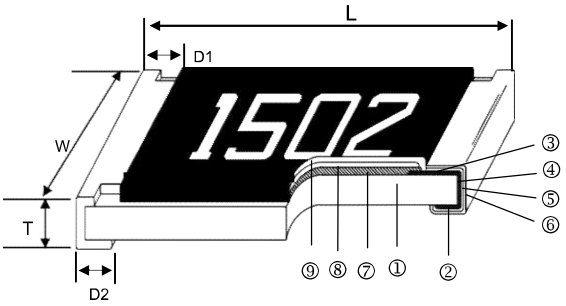
■Scope

—This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

■Features

—AEC-Q200 Compliance
—Highly reliable multilayer electrode construction
—Special construction to prevent sulfuration in a sulfur containing environment
—Compatible with all soldering process
—100% CCD inspection

■Construction



①	Alumina Substrate	④	Edge Electrode	⑦	Resistor Layer
②	Bottom Electrode	⑤	Barrier Layer	⑧	Primary Overcoat
③	Top Electrode	⑥	External Electrode	⑨	Secondary Overcoat

■Applications

—Automotive Industry
—Telecommunication Equipments
—Radio and Tape Recorders, TV Tuners
—Digital Cameras, Watches, Pocket Calculators
—Computers, Instruments
—Medical Equipment

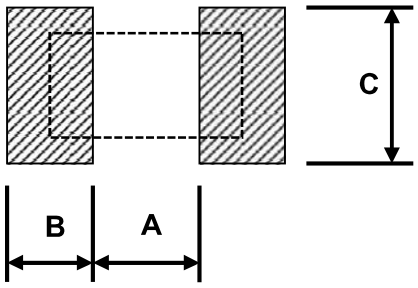
■Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)
AFPF02	0402	1.00±0.05	0.50±0.05	0.35±0.05	0.20±0.10	0.20±0.10
AFPF03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20
AFPF05	0805	2.00±0.10	1.25±0.10	0.50±0.10	0.35±0.20	0.40±0.20
AFPF06	1206	3.10±0.10	1.55±0.10	0.55±0.10	0.50±0.25	0.50±0.20
AFPF10	1210	3.10±0.10	2.60±0.15	0.55±0.10	0.50±0.25	0.50±0.20
AFPF20	2010	5.00±0.10	2.50±0.15	0.55±0.10	0.60±0.25	0.50±0.20
AFPF25	2512	6.35±0.10	3.10±0.15	0.55±0.10	0.60±0.25	0.50±0.20

■PartNumbering

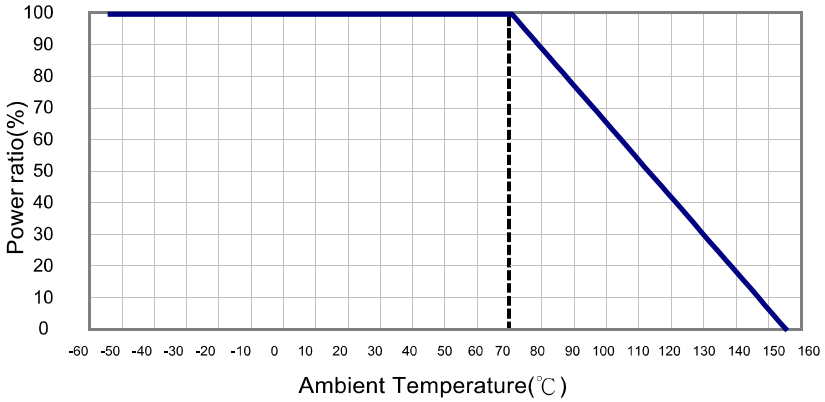
AFPF	06	100R	F	1/2W
Type	Size	Value	Tolerance	Power
	02 : 0402		D : ±0.5%	1/10W
	03 : 0603		J : ±5%	1/8W
	05 : 0805		F : ±1%	1/4W
	06 : 1206			1/3W
	10 : 1210			1/2W
	20 : 2010			1W
	25 : 2512			1.25W
				2W

■RecommendLandPattern

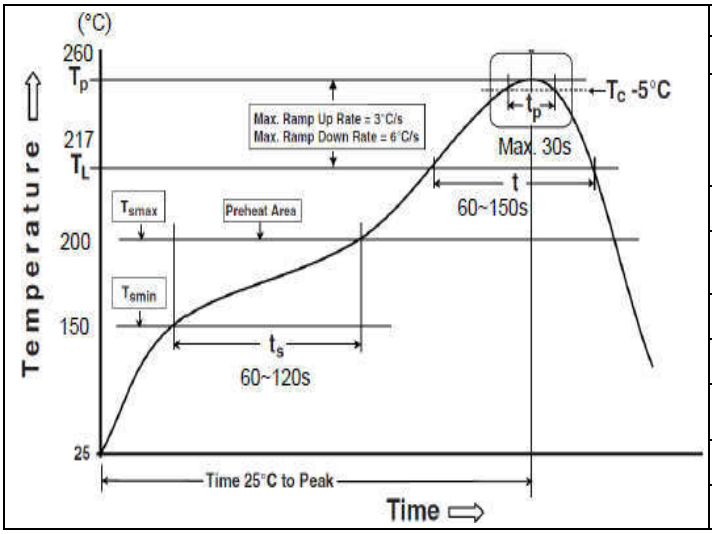


Type	A (mm)	B (mm)	C (mm)
AFPF02	0.50	0.45	0.60
AFPF03	0.90	0.60	0.90
AFPF05	1.20	0.70	1.30
AFPF06	2.00	0.90	1.60
AFPF10	2.00	0.90	2.80
AFPF20	3.80	0.90	2.80
AFPF25	4.90	1.60	3.50

■DeratingCurve



■Soldering Condition (Ref. IPC/JEDEC J-STD-020 &J-STD-002)



Reflow Profiles	
Profile Feature	**Pb-Free Assembly**
Preheat Min. Temperature (Tsmin) Max Temperature (Tsmax) Preheating time (ts) from (Tsmin to Tsmax)	 150 °C 200 °C 60-120 seconds
Ramp-up rate (T_L to Tp)	3 °C/second max.
Liquidous temperature (T_L) Time (t_L) maintained above T_L	217 °C 60-150 seconds
Min. Peak temperature (Tp min)	235°C
Max. Peak temperature (Tp max)	260°C
Time (tp) within 5 °C of the specified classification temperature (Tc)	30 seconds max.
Ramp-down rate (Tp to T_L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

■High Power Rating ElectricalSpecifications

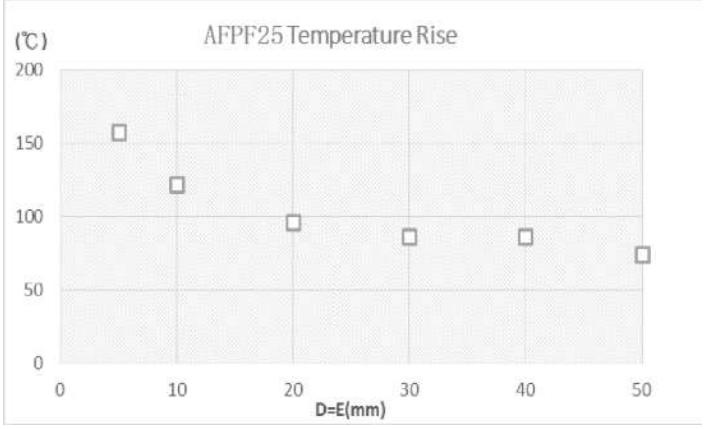
Item / Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range ±0.5% (E24、E96)	Resistance Range ±1% (E24、E96)	Resistance Range ±5% (E24)	TCR (PPM/°C)
AFPF02	1/10W	-55 ~ +155°C	50V	100V	-	1Ω - 9.76Ω		±200
	1/8W				10Ω - 1MΩ			±100
AFPF03	1/4W		75V	150V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
AFPF05	1/3W		150V	300V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
AFPF06	1/2W		200V	400V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
AFPF10	1/2W 1W		200V	400V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100
	1/2W					1.02MΩ - 10MΩ		±200
AFPF20	1W		200V	400V	-	1Ω - 9.76Ω		±200
	1.25W				10Ω - 1MΩ			±100
AFPF25	2W		250V	500V	-	1Ω - 9.76Ω		±200
					10Ω - 1MΩ			±100

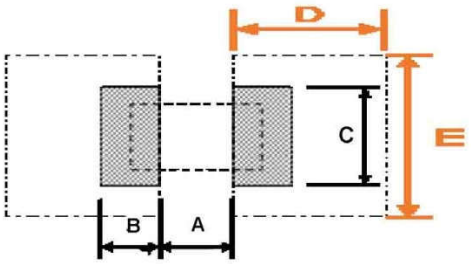
■High Current Jumper (0Ω)

Item / Type	Rated Curre`nt	Resistance 0Ω	Operating Temp. Range	remarks
AFPF02	1.5A	<20mΩ	-55 ~ +155°C	Jumper products do not display tolerances.
AFPF03	2A			
AFPF05	2.5A			
AFPF06	3.5A			
AFPF10	5A			
AFPF20	6A			
AFPF25	7A			

Operating Voltage=√(P*R) or Max. Operating Voltage listed above, whichever is lower.
Overload Voltage=2.5*√(P*R) or Max. Overload Voltage listed above, whichever is lower.
The power rating depends on the maximum temperature of the resistive element. Due to the power dissipation of the resistor, the temperature of the resistive element will rise depending on the condition of heat dissipation from PCB. The maximum power rating in application only applies if the temperature of the resistive element is not exceed 155 ° C.
■HKR is capable of manufacturing the optional spec based on customer'srequirement.

■Temperature Rise





＊FR4 copper board, 35μm of copper pad thickness.

■EnvironmentalCharacteristics

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			**JIS-C-5201-1 4.8** **IEC-60115-1 4.8** At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	**JIS-C-5201-1 4.13** **IEC-60115-1 4.13** RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G			**JIS-C-5201-1 4.6** **IEC-60115-1 4.6** Max. Overload Voltage for 1 minute
Operational Life	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	**MIL-STD-202 Method 108** Steady State TA=125°C at derated power. Measurement at 24±4 hours after test conclusion.
Biased Humidity	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	**MIL-STD-202 Method 103** 1000 hrs 85°C/85%RH 10% of operating power
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	**MIL-STD-202 Method 108** at +155°C for 1000 hrs
Board Flex	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	**AEC-Q200-005** Bending once for 60 seconds 2010, 2512sizes:2mm Other sizes:3mm
Solderability	95% min. coverage			**JIS-C-5201-1 4.17** **IEC-60115-1 4.17** **J-STD-002** 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	**MIL-STD-202 Method 210** 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			**JIS-C-5201-1 4.7** **IEC-60115-1 4.7** 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≦5% Total leaching area ≦ 10%			**JIS-C-5201-1 4.18** **IEC-60068-2-58 8.2.1** 260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	**JESD22 Method JA-104** -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	**MIL-STD-202 Method 213** Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	**MIL-STD-202 Method 204** 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(3%+0.05Ω)			**AEC-Q200-002** Human body model 0402/0603: 1KV 0805 and above: 2KV
	±(1%+0.05Ω)			**IEC61340-3-1(Equivalent to MIL-STD-883)** 3 positive + 3 negative discharges ESD voltage acc. to size

Item	Requirement			Test Method
	±1%	±5%	Jumper	
Resistance to Solvents	No visible damage on appearance and marking.			**MIL-STD-202 Method 215** Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			**AEC-Q200-006** Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			**UL-94** V-0 or V-1 are acceptable. Electrical test not required.
Sulfur Test	△R±1%		<50mΩ	**EIA-977 (Condition A)** 60±2°C, no power rating for 500 hrs.

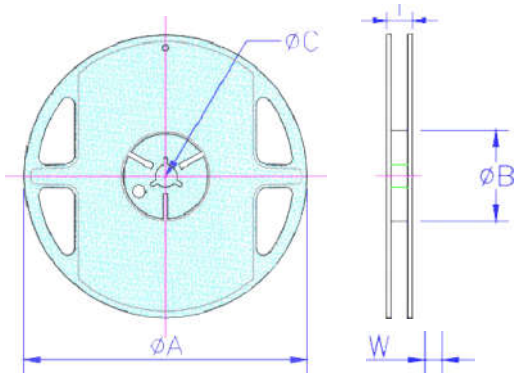
RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

■**Storage Temperature: 15~28°C; Humidity <80%RH**

■**Shelf Life: 2 years from production date.**

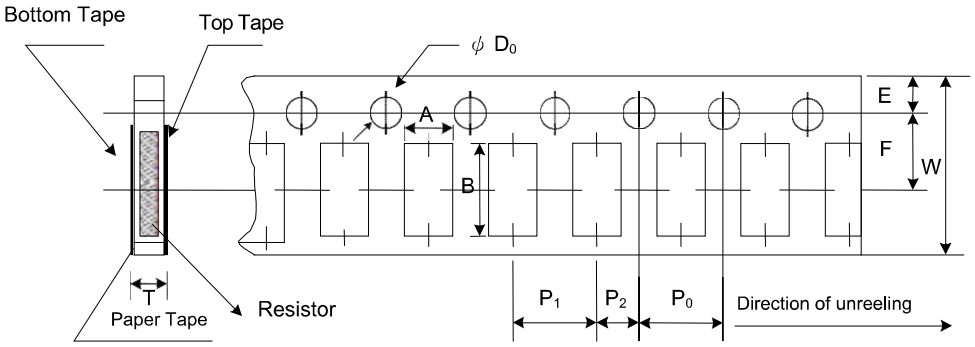
■Packaging

Reel Specifications & Packaging Quantity



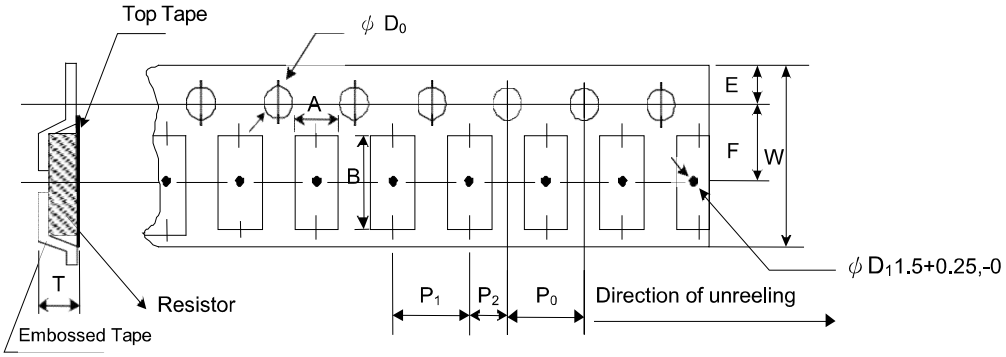
Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
AFPF02	Paper	10K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AFPF03 AFPF05 AFPF06 AFPF10	Paper	5K	8mm	7 inch	178.5±1.5	60+1/-0	13.0±0.2	9.0±0.5	12.5±0.5
		10K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		20K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
AFPF20 AFPF25	Embossed	4K	12mm	7 inch	178.5±1.5	60+1/-0	13.0±0.5	13.0±0.5	15.5±0.5
		8K	12mm	10 inch	250±1.0	62±0.5	13.0±0.5	12.5±0.5	16.5±0.5

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	ΦD_0 (mm)	T (mm)
AFPF02	0.65±0.10	1.15±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.10
AFPF03	1.10±0.10	1.90±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.10
AFPF05	1.60±0.10	2.40±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AFPF06	1.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10
AFPF10	2.90±0.10	3.50±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.10

Embossed Plastic Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	ΦD_0 (mm)	T (mm)
AFPF20	2.8±0.10	5.40±0.20	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2^{+0}
AFPF25	3.5±0.10	6.7±0.10	12.0±0.30	1.75±0.10	5.5±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1, -0	1.2^{+0}

■Marking

No Marking for0402

Jumper for all: Letter "0"

1% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

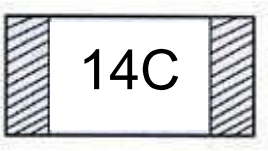
Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
Marking	1000	2201	1002	4992	1003

5% for 0603/0805/1206/1210/2010/2512: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1^{st} and 2^{nd} are E24 code and 3^{rd} code is multiplier)

E24 code	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91

1% for 0603(E24): 3 digits marking in E24, When the E24 and E96 are the same resistance, this marking in E96 Example:01A=100Ω 05C=11KΩ 123=12KΩ 273=27KΩ



1% for 0603(E96): 3 digits marking in E96

3 digits marking forExample:14C=13K7Ω 13C=13K3Ω

68B=4K99Ω 68X=49.9Ω

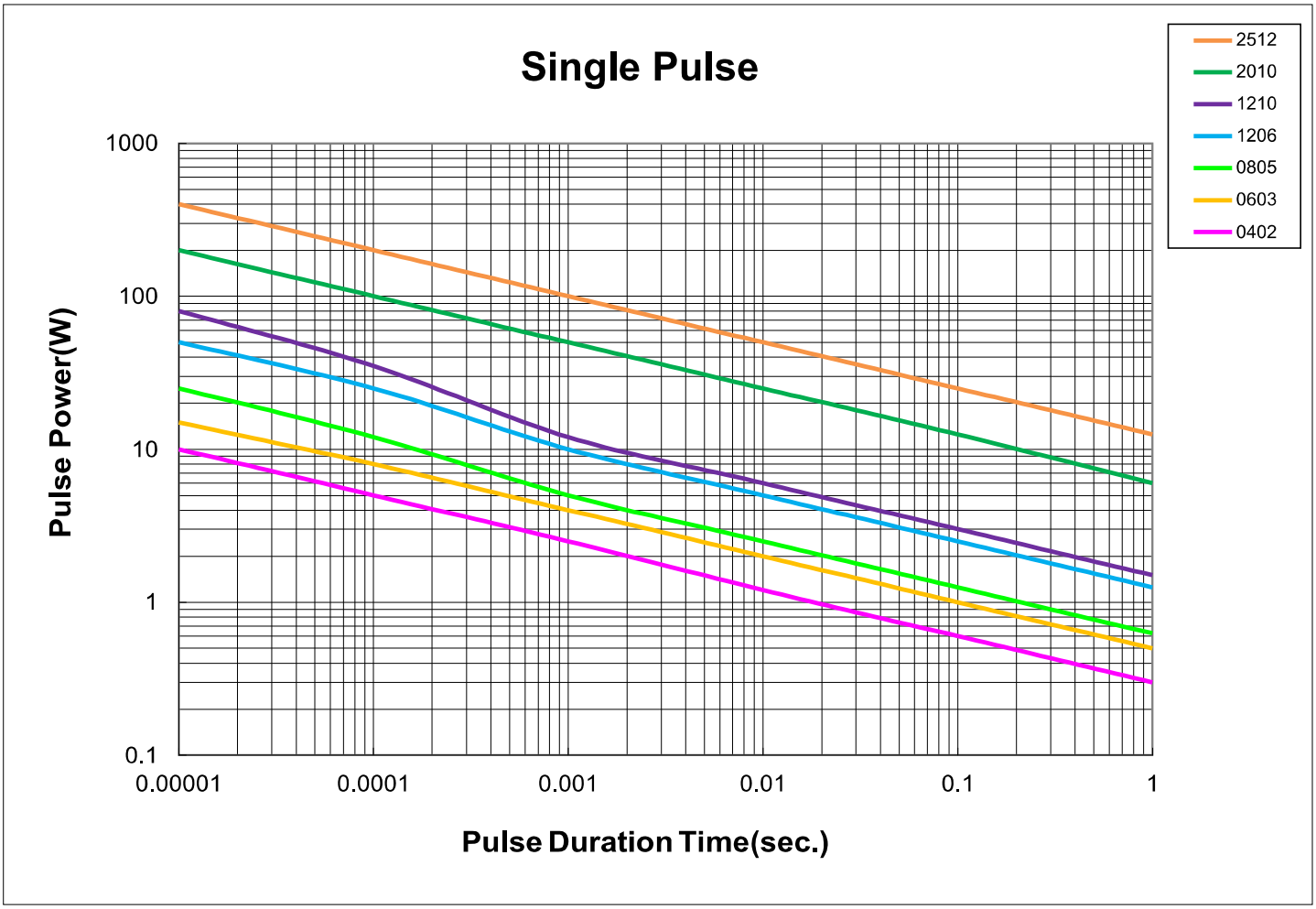
■Marking Table

Code	E96	Code	E96	Code	E96	Code	E96
01	100	**25**	178	**49**	316	**73**	562
02	102	**26**	182	**50**	324	**74**	576
03	105	**27**	187	**51**	332	**75**	590
04	107	**28**	191	**52**	340	**76**	604
05	110	**29**	196	**53**	348	**77**	619
06	113	**30**	200	**54**	357	**78**	634
07	115	**31**	205	**55**	365	**79**	649
08	118	**32**	210	**56**	374	**80**	665
09	121	**33**	215	**57**	383	**81**	681
10	124	**34**	221	**58**	392	**82**	698
11	127	**35**	226	**59**	402	**83**	715
12	130	**36**	232	**60**	412	**84**	732
13	133	**37**	237	**61**	422	**85**	750
14	137	**38**	243	**62**	432	**86**	768
15	140	**39**	249	**63**	442	**87**	787
16	143	**40**	255	**64**	453	**88**	806
17	147	**41**	261	**65**	464	**89**	825
18	150	**42**	267	**66**	475	**90**	845
19	154	**43**	274	**67**	487	**91**	866
20	158	**44**	280	**68**	499	**92**	887
21	162	**45**	287	**69**	511	**93**	909
22	165	**46**	294	**70**	523	**94**	931
23	169	**47**	301	**71**	536	**95**	953
24	174	**48**	309	**72**	549	**96**	976

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

■Pulse withstandingcapacity

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.



Note: *The limit of the applicable voltage is the max. overload voltage. Please consult us about the resistance characteristic when pulse is applied continuously. This data is a reference value, please be sure to test the products on the actual circuit before you use them.*