

Data Sheet

Customer: _____

Product: Pulse Withstanding Chip Resistor - PWR Series

Size: 0402/0603/0805/1206/1210/2010/2512

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Pulse Withstanding Chip Resistor – PWR Series



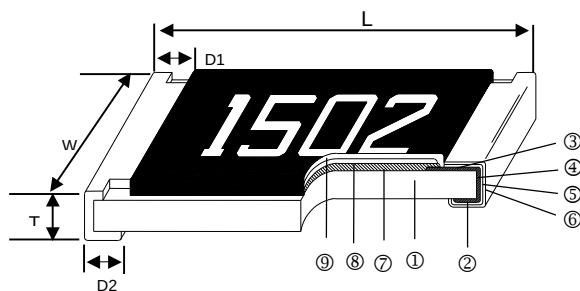
■ Features

- Tolerance from $\pm 0.5\%$ ~5%
- High power rating
- Excellent pulse withstanding performance
- Improved working voltage ratings
- Standard package sizes of 0402~2512
- AEC-Q200 Compliance

■ Applications

- Metering (Testing/Measurement)
- Diagnostic Equipment
- Medical Devices
- Industrial Controls
- Plasma
- LCD Video Monitors

■ Construction

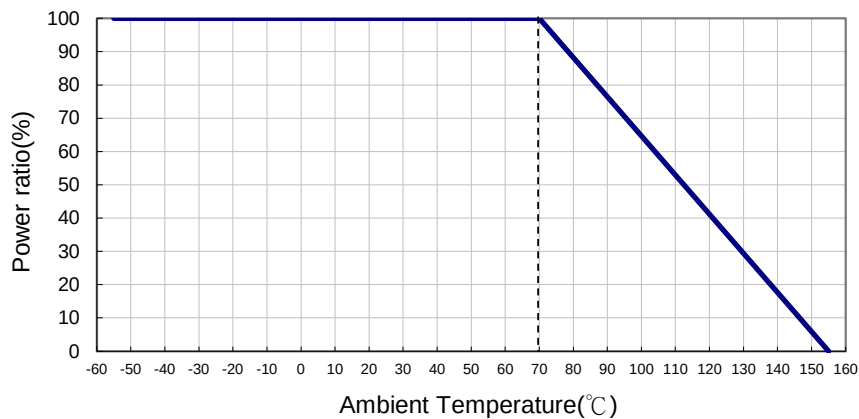


① Alumina Substrate	⑥ External Electrode
② Bottom Electrode	⑦ Resistor Layer
③ Top Electrode	⑧ Primary Overcoat
④ Edge Electrode	⑨ Secondary Overcoat
⑤ Barrier Layer	

■ Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
PWR02	0402	1.00 $\pm$ 0.05	0.50 $\pm$ 0.05	0.35 $\pm$ 0.05	0.20 $\pm$ 0.10	0.20 $\pm$ 0.10	0.6
PWR03	0603	1.60 $\pm$ 0.10	0.80 $\pm$ 0.10	0.45 $\pm$ 0.10	0.30 $\pm$ 0.20	0.30 $\pm$ 0.20	2.0
PWR05	0805	2.00 $\pm$ 0.10	1.25 $\pm$ 0.10	0.50 $\pm$ 0.10	0.35 $\pm$ 0.20	0.40 $\pm$ 0.20	4.4
PWR05 (1/2W)	0805	2.00 $\pm$ 0.10	1.25 $\pm$ 0.10	0.50 $\pm$ 0.10	0.35 $\pm$ 0.20	0.40 $\pm$ 0.20	5.0
PWR06	1206	3.10 $\pm$ 0.10	1.55 $\pm$ 0.10	0.55 $\pm$ 0.10	0.50 $\pm$ 0.25	0.50 $\pm$ 0.20	8.9
PWR06 (3/4W)	1206	3.10 $\pm$ 0.10	1.55 $\pm$ 0.10	0.55 $\pm$ 0.10	0.50 $\pm$ 0.25	0.50 $\pm$ 0.20	9.5
PWR13	1210	3.10 $\pm$ 0.10	2.60 $\pm$ 0.15	0.55 $\pm$ 0.10	0.50 $\pm$ 0.25	0.50 $\pm$ 0.20	16.0
PWR10	2010	5.00 $\pm$ 0.10	2.50 $\pm$ 0.15	0.55 $\pm$ 0.10	0.60 $\pm$ 0.25	0.50 $\pm$ 0.20	24.2
PWR12	2512	6.35 $\pm$ 0.10	3.10 $\pm$ 0.15	0.55 $\pm$ 0.10	0.60 $\pm$ 0.25	0.50 $\pm$ 0.20	39.4
PWR12(2W)	2512	6.35 $\pm$ 0.20	3.15 $\pm$ 0.15	0.60 $\pm$ 0.10	0.60 $\pm$ 0.25	0.60 $\pm$ 0.20	42.0

Derating Curve



Part Numbering

PWR	12	J	T	E	A	1001	
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking
	02: 0402 03: 0603 05: 0805 06: 1206 13: 1210 10: 2010 12: 2512	D: ±0.5% F: ±1% J: ±5% -: No specified	T: 7"Taping Reel V:10"Taping Reel W:13"Taping Reel	E: ±100 F: ±200 G: ±300 4 : ±350 -: No specified	A: 1.5W T: 1W Q: 3/4W U: 1/2W G: 2/5W O: 1/3W V : 1/4W W: 1/8W X: 1/10W P: 1/5W S: 2W K: 1.25W	1001: 1KΩ 1004: 1MΩ R0R0: 0Ω	: Standard Marking N: No Marking

Standard Electrical Specifications

Item Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR02 (0402)	1/5W	-55 ~ +155°C	50V	100V	-	1Ω-20Ω		±300
					100Ω-1MΩ	20Ω-1MΩ		±100
PWR03 (0603)	1/10W	-55 ~ +155°C	50V	100V	10Ω - 294Ω	1Ω - 294Ω		±200
					10Ω - 1MΩ			±100
PWR05 (0805)	1/8W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
					10Ω- 20MΩ			±100
PWR06 (1206)	1/3W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω- 20MΩ			±100
PWR13 (1210)	1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω- 20MΩ			±100
PWR10 (2010)	3/4W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω - 20MΩ			±100
PWR12 (2512)	1.5W	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω - 20MΩ			±100

High Power & Ultra High Power Rating Electrical Specifications

Type \ Item	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
	Jumper Rated Current				±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
PWR03 (0603)	1/4W 1/3W	-55 ~ +155°C	75V	150V	10Ω - 294Ω	1Ω - 294Ω		±200
	10Ω - 1MΩ				±100			
	Jumper: 5A*				- 0Ω(≤8mΩ)		-	
PWR05 (0805)	2/5W	-55 ~ +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
					10Ω - 1MΩ			±100
PWR05 (0805)	1/2W *	-55 ~ +155°C	400V	600V	10Ω - 294Ω	1Ω - 294Ω		±200
	10Ω - 1MΩ				±100			
	Jumper: 6A*				- 0Ω(≤5mΩ)		-	
PWR06 (1206)	1/2W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω - 1MΩ			±100
PWR06 (1206)	3/4W *	-55 ~ +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
	10Ω - 1MΩ				±100			
	Jumper: 10A*				- 0Ω(≤5mΩ)		-	
PWR13 (1210)	3/4W 1W	-55 ~ +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω - 1MΩ			±100
PWR10 (2010)	1W 1.25W	-55 ~ +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
					10Ω - 1MΩ			±100
PWR12 (2512)	2W *	-55 ~ +155°C	500V	1000V	10Ω	1Ω - 10Ω		±350
					10Ω - 200K			±100

*: Ultra High Power: double side printed resistor element

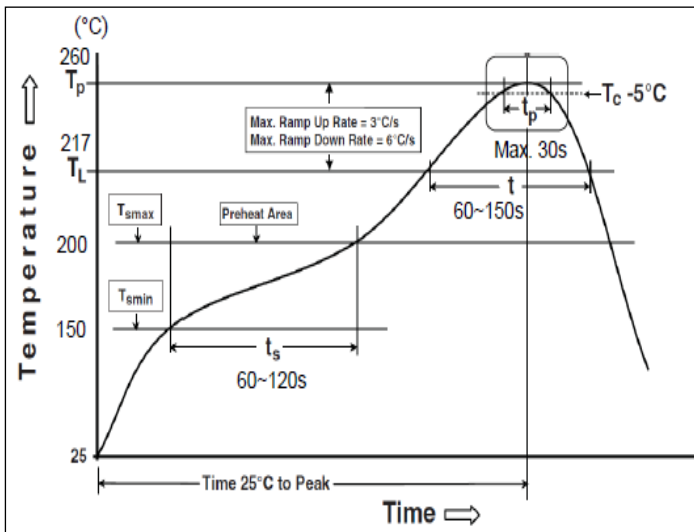
Operating Voltage= $\sqrt{P \cdot R}$ or Max. Operating Voltage listed above, whichever is lower.

Overload Voltage= $2.5 \cdot \sqrt{P \cdot R}$ 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.

■ Viking is capable of manufacturing the optional spec based on customer's requirement.

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



Reflow Profiles	
Profile Feature	Pb-Free Assembly
Preheat	
Min. Temperature (T _{sm})	150 °C
Max Temperature (T _{max})	200 °C
Preheating time (ts) from (T _{sm} to T _{max})	60-120 seconds
Ramp-up rate (T _L to T _p)	3 °C/second max.
Liquidous temperature (T _L)	217 °C
Time (t _L) maintained above T _L	60-150 seconds
Min. Peak temperature (T _p min)	235°C
Max. Peak temperature (T _p max)	260°C
Time (tp) within 5 °C of the specified classification temperature (T _c)	30 seconds max.
Ramp-down rate (T _p to T _L)	6 °C/second max.
Time 25 °C to peak temperature	8 minutes max.

■ Environmental Characteristics

Item	Requirement		Test Method
	±5% and Below	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)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds Jumper: 2*I _{max} for 5 seconds
Insulation Resistance	≥10G		JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.05Ω)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Damp Heat with Load	±(0.5%+0.05Ω)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.24 IEC-60115-1 4.24 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
	Ultra High Power * ±(1.0%+0.05Ω)		
Dry Heat	±(0.5%+0.05Ω)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.23 IEC-60115-1 4.23.2 at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage		JIS-C-5201-1 4.17 IEC-60115-1 4.17 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	0603: ≤8mΩ 0805: ≤5mΩ 1206: ≤5mΩ	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260±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

Item	Requirement		Test Method
	±5% and Below	Jumper	
Rapid Change of Temperature	$\pm(0.5\%+0.05\Omega)$	0603: $\leq 8m\Omega$ 0805: $\leq 5m\Omega$ 1206: $\leq 5m\Omega$	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +155°C, 5 cycles

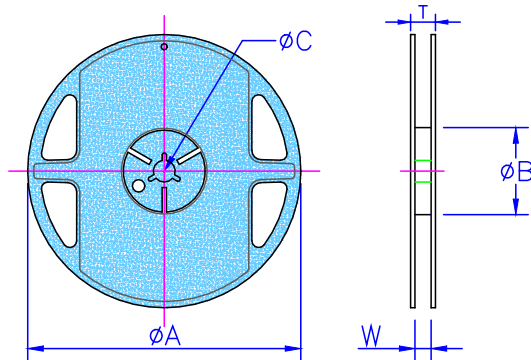
RCWV(Rated Continuous Working Voltage)= $\sqrt{P \cdot R}$ or Max. Operating Voltage whichever is lower.

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

■Shelf Life: 2 years from production date.

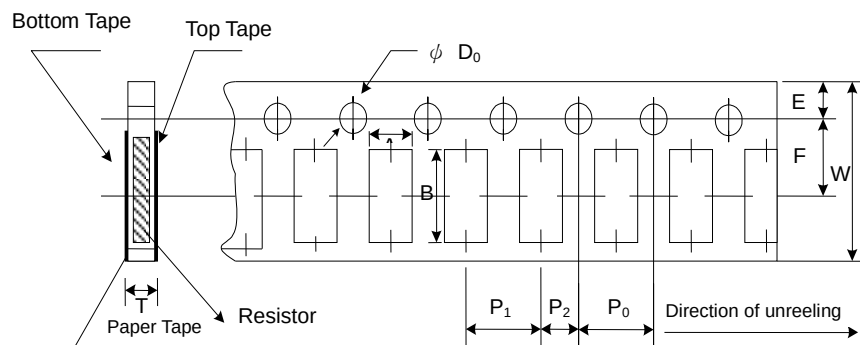
■Packaging

Reel Specifications & Packaging Quantity



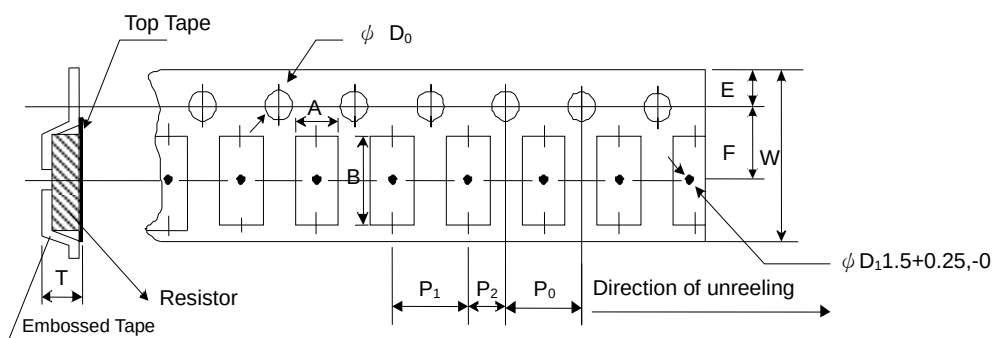
Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
PWR02	Paper	10K	8mm	7 inch	178.5±1.5	60 ^{+1/-0}	13.0±0.2	9.0±0.5	12.5±0.5
		20K	8mm	10 inch	254±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
		40K	8mm	13 inch	330±1.0	100±0.5	13.0±0.2	9.5±0.5	13.5±0.5
PWR03 PWR05 PWR06 PWR13	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
PWR10 PWR12	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)	P0 (mm)	P1 (mm)	P2 (mm)	ΦD0 (mm)	T (mm)
PWR02	0.65±0.10	1.15±0.10	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	2.00±0.05	2.00±0.05	1.50+0.1,-0	0.45±0.1
PWR03	1.10±0.10	1.90±0.1	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.70±0.1
PWR05	1.60±0.10	2.40±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
PWR06	1.90±0.10	3.50±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1
PWR13	2.90±0.10	3.50±0.2	8.00±0.2	1.75±0.1	3.50±0.05	4.00±0.10	4.00±0.05	2.00±0.05	1.50+0.1,-0	0.85±0.1

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)
PWR10	2.80±0.10	5.40±0.20	12.0±0.3	1.75±0.1	5.50±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰
PWR12	3.50±0.10	6.70±0.10	12.0±0.3	1.75±0.1	5.50±0.05	4.00±0.10	4.00±0.1	2.00±0.05	1.50+0.1, -0	1.2 ⁺⁰

■ Marking

No Marking for 0402

0805~2512 4 digits marking for Example

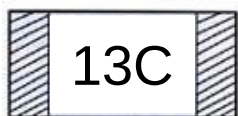
Resistance	5.6Ω	97.6Ω	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ	1MΩ
marking	5R60	97R6	1000	2201	1002	4992	1003	1004

0603: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1st and 2nd are E24 code and 3rd 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
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1% for 0603: 3 digits marking in E96 (E96 series except E24 series)

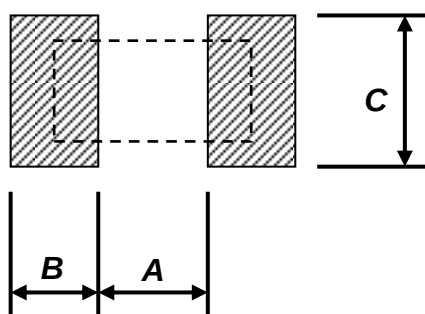


digits marking for Example: 13C=13K3Ω 68B=4K99Ω 68X=49.9Ω

Marking Table

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

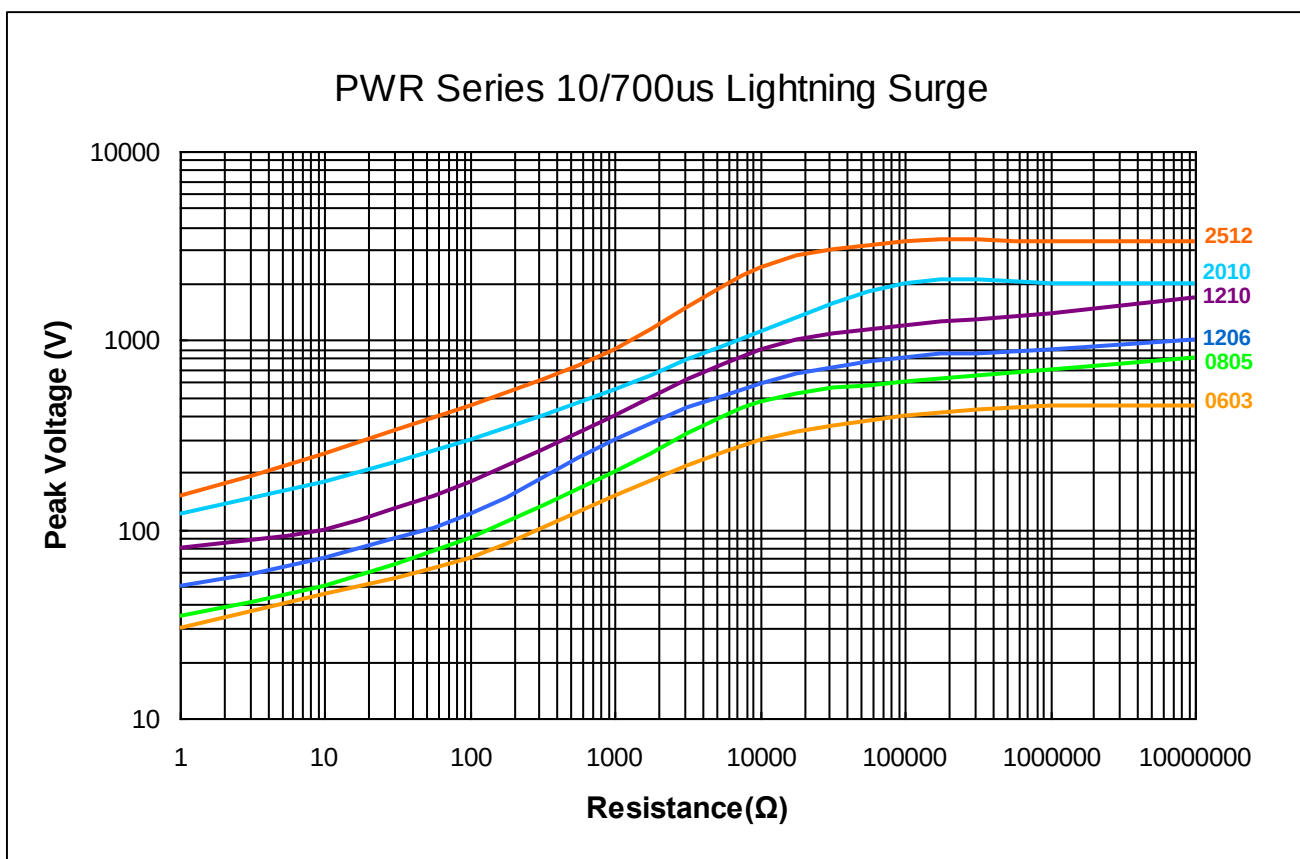
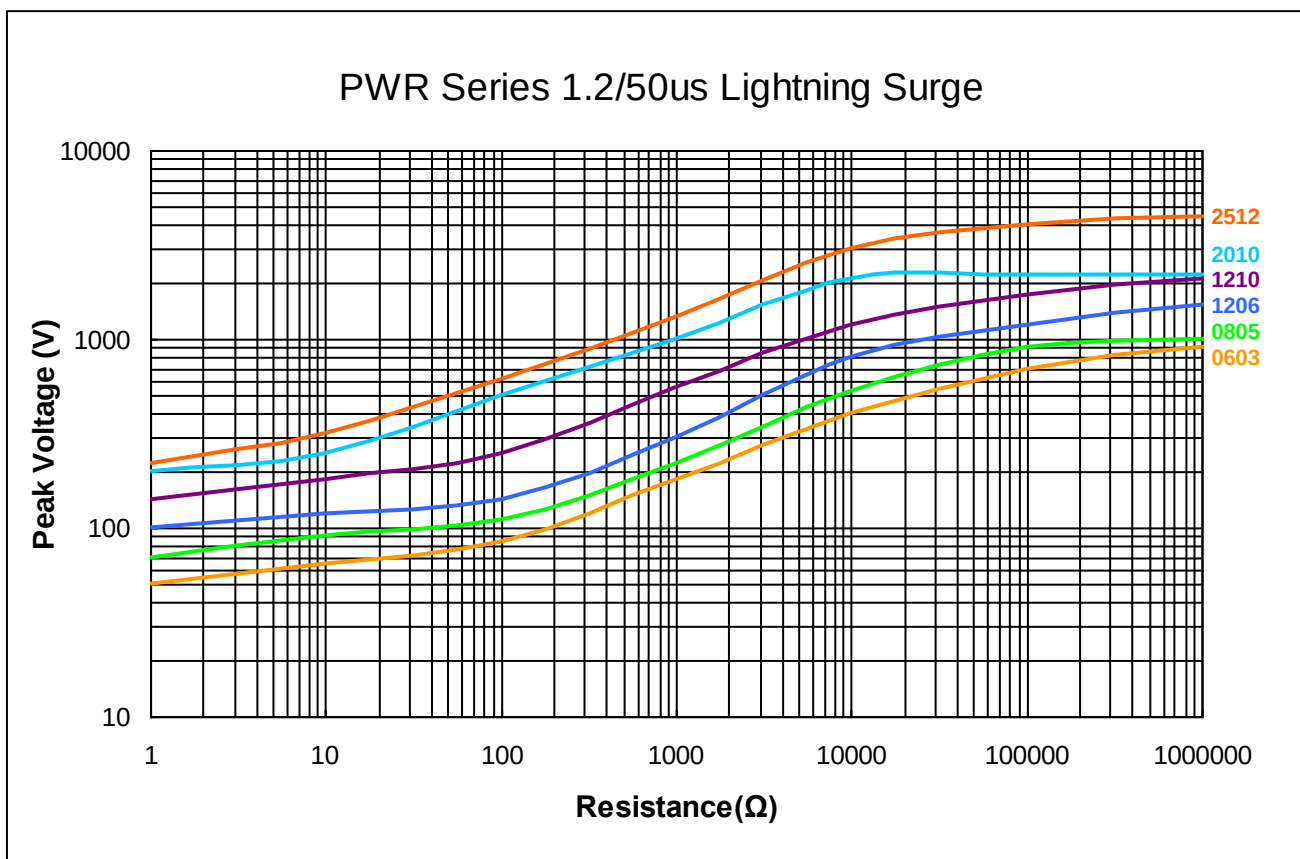
Recommend Land Pattern



Type	A (mm)	B (mm)	C (mm)
PWR02	0.50	0.45	0.60
PWR03	0.90	0.60	0.90
PWR05	1.20	0.70	1.30
PWR06	2.00	0.90	1.60
PWR13	2.00	0.90	2.80
PWR10	3.80	0.90	2.80
PWR12	4.90	1.00	3.40

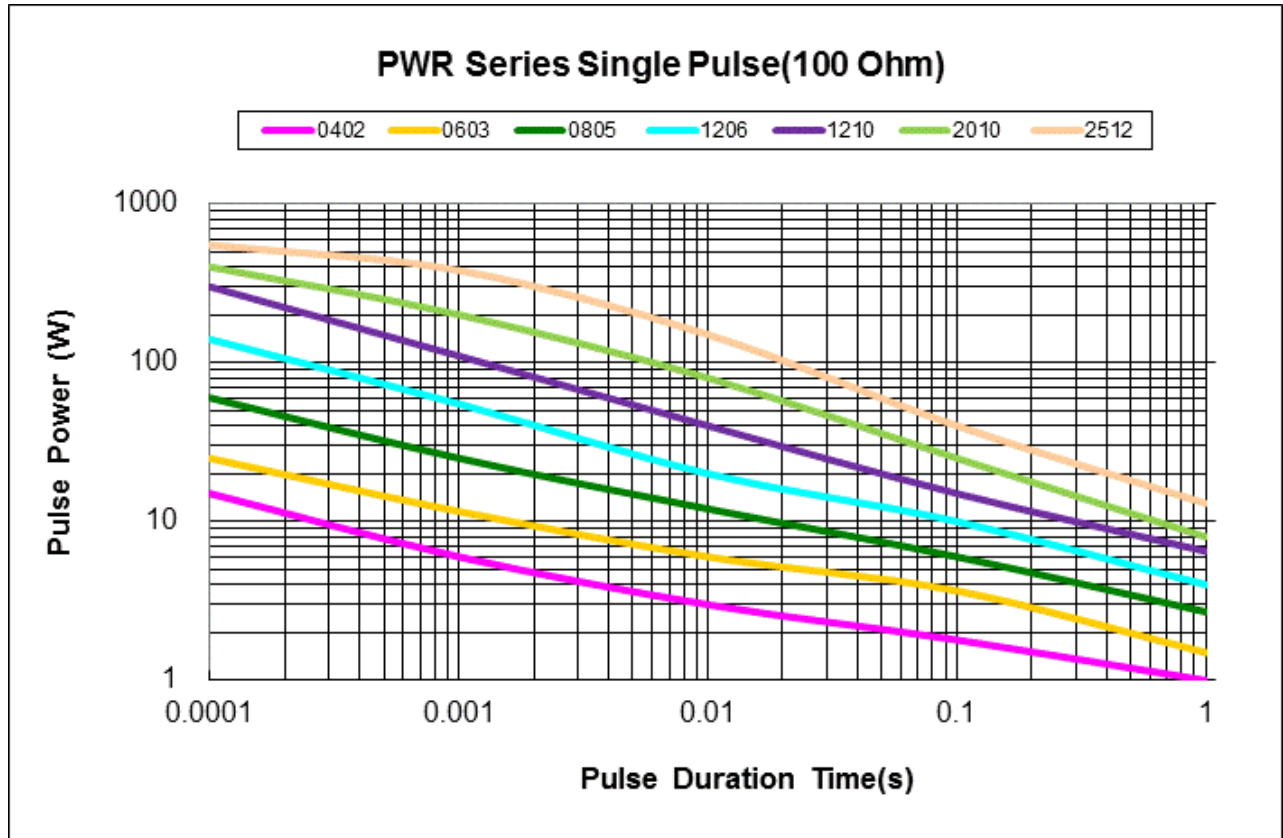
■ Lightning Surge

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.



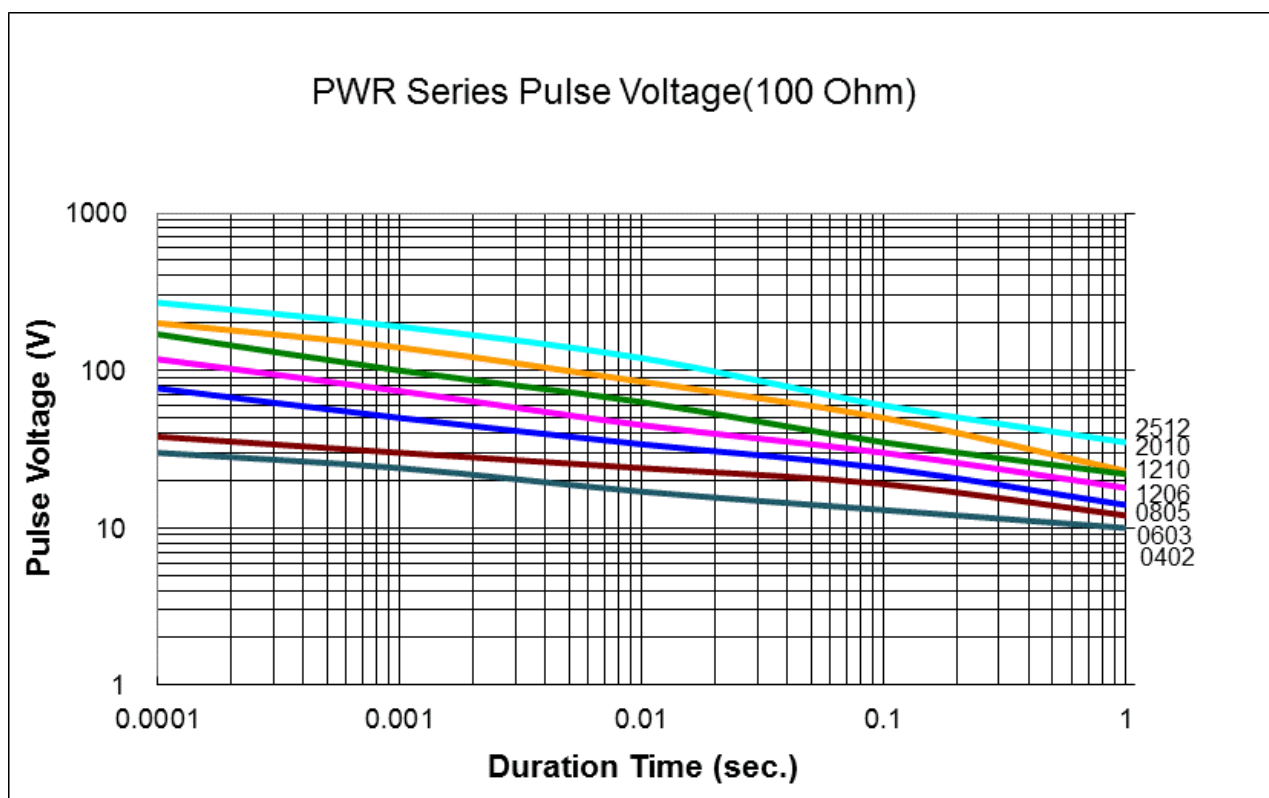
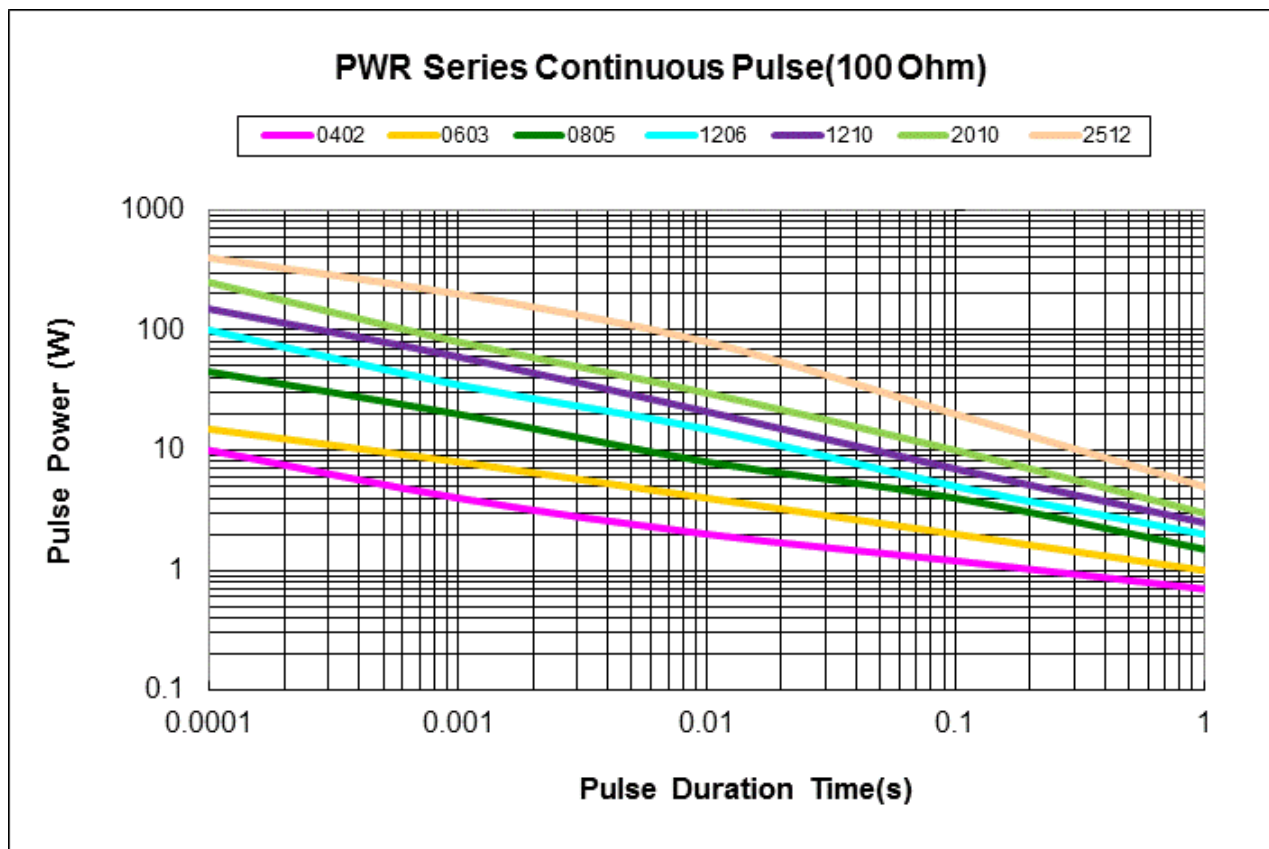
■ Pulse withstanding capacity

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.



Continuous Pulse

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.



REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version C	Jun 03, 2014	-	- Environmental Characteristics updated
Version C1	Apr 21, 2016	-	- Features increase AEC-Q200 Compliance
Version C2	Jul 15, 2016	-	- Modify Storage Temperature
Version C3	Oct 13, 2017	-	- Increase High Power Specifications
Version C4	Jul 27, 2018	-	- Increase 0402 size Electrical Specifications - Increase 0805/1206 Ultra High Power Electrical Specifications
Version C5	May 20, 2019	-	- Modify TCR Test description
Version C6	Jan 31, 2020	-	- Increase PWR2512 2W - Increase 0603 / 0805/1206 High power rating 0R (Jumper)
Version C7	Mar 10, 2021	-	- Modify Bending Test description - Increase large reel packaging code - Modify 2010 Embossed Plastic Tape B Specification - Modify Soldering Condition (IPC/JEDEC J-STD-020)
Version C8	Nov 15, 2021	-	- Increase the shelf life description
Version C9	Feb 15, 2022	-	- Derating Curve changes the temperature range
Version D	Jun 15, 2022	-	- Modify Soldering Condition
Version D1	Jan 31, 2023	-	- Increase 2010 1.25W
Version D2	Jul 06, 2023	-	- Electrical Specifications updated
Version D3	Jul 21, 2023	-	- Increase 0603 1/3W - Increase 1210 1W
Version D4	Oct 02, 2023	-	- Electrical Specifications updated