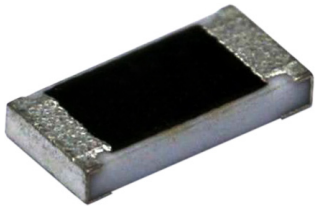
Chip Resistors
Pulse Withstanding



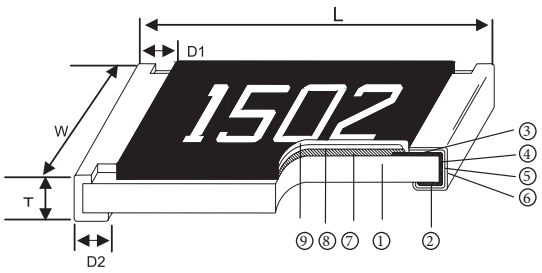
Features

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

Applications

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

Construction



1	Alumina Substrate
2	Bottom Electrode (Ag)
3	Top Electrode (Ag-Pd)
4	Edge Electrode (NiCr)
5	Barrier Layer (Ni)
6	External Electrode (Sn)
7	Resistor Layer (RuO2 / Ag)
8	Primary Overcoat (Glass)
9	Secondary Overcoat (Epoxy)

Dimensions

Part Number	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1,000 pieces)
MCPWR02	0402	1 ±0.05	0.5 ±0.05	0.35 ±0.05	0.2 ±0.1	0.2 ±0.1	0.63
MCPWR03	0603	1.6 ±0.1	0.8 ±0.1	0.45 ±0.1	0.3 ±0.2	0.3 ±0.2	2.042
MCPWR05	0805	2 ±0.1	1.25 ±0.1	0.5 ±0.1	0.35 ±0.2	0.4 ±0.2	4.368
MCPWR05 (1/2W)	0805	2 ±0.1	1.25 ±0.1	0.5 ±0.1	0.35 ±0.2	0.4 ±0.2	5.049
MCPWR06	1206	3.1 ±0.1	1.55 ±0.1	0.55 ±0.1	0.5 ±0.25	0.5 ±0.2	8.947
MCPWR06 (3/4W)	1206	3.1 ±0.1	1.55 ±0.1	0.55 ±0.1	0.5 ±0.25	0.5 ±0.2	9.541
MCPWR13	1210	3.1 ±0.1	2.6 ±0.15	0.55 ±0.1	0.5 ±0.25	0.5 ±0.2	15.959
MCPWR10	2010	5 ±0.1	2.5 ±0.15	0.55 ±0.1	0.6 ±0.25	0.5 ±0.2	24.241
MCPWR12	2512	6.35 ±0.1	3.1 ±0.15	0.55 ±0.1	0.6 ±0.25	0.5 ±0.2	39.448

Chip Resistors
Pulse Withstanding

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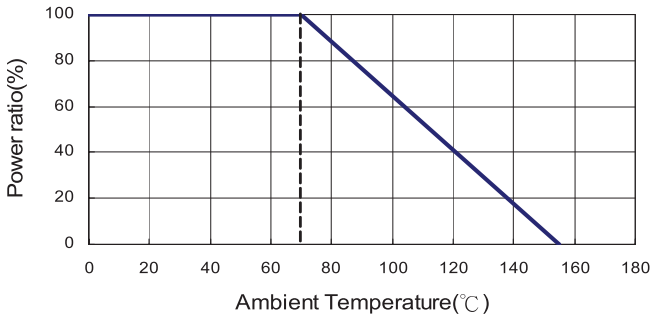
Derating Curve:



Standard Electrical Specifications

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)	
0402	1/5W	-55°C to +155°C	50V	100V	-	1Ω-20Ω		±300
					100Ω-1MΩ	20.5Ω-1MΩ		±100
0603	1/10W	-55°C to +155°C	50V	100V	10Ω - 294Ω	1Ω - 294Ω		±200
					300Ω - 1MΩ			±100
0805	1/8W	-55°C to +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
					300Ω - 20MΩ			±100
1206	1/3W	-55°C to +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 20MΩ			±100
1210	1/2W	-55°C to +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 20MΩ			±100
2010	3/4W	-55°C to +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 20MΩ			±100
2512	1.5W	-55°C to +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 20MΩ			±100

High Power and Ultra High Rating Electrical Specifications

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)	
0603)	1/4W	-55°C to +155°C	75V	150V	10Ω - 294Ω	1Ω - 294Ω		±200
					300Ω - 1MΩ			±100
0805	2/5W	-55°C to +155°C	150V	300V	10Ω - 294Ω	1Ω - 294Ω		±200
					300Ω - 1MΩ			±100
0805	1/2W *	-55°C to +155°C	400V	600V	10Ω - 294Ω	1Ω - 294Ω		±200
					300Ω - 1MΩ			±100

Chip Resistors
Pulse Withstanding

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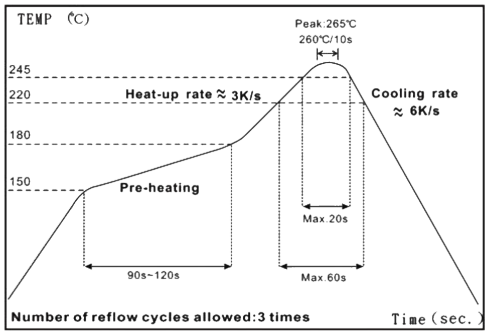
Type	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Resistance Range			TCR (PPM/°C)
					±0.5% (E24,E96)	±1% (E24,E96)	±5% (E24)	
1206	1/2W	-55°C to +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 1MΩ			±100
1206	3/4W *	-55°C to +155°C	500V	1000V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 1MΩ			±100
1210	3/4W	-55°C to +155°C	200V	400V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 1MΩ			±100
2010	1W	-55°C to +155°C	400V	800V	10Ω - 20Ω	1Ω - 20Ω		±200
					20.5Ω - 1MΩ			±100

*Ultra High Power: Double side printed resistor element
Operating voltage = √ (P × R) or maximum operating voltage listed above, whichever is lower.
Overload voltage = 2.5 × √ (P × R) or maximum overload voltage listed above, whichever is lower.

Soldering Condition

Pulse Withstanding Chip Resistor



IR Reflow Soldering

(1) Time of IR reflow soldering at maximum temperature point 260°C : 10s

Environmental Characteristics

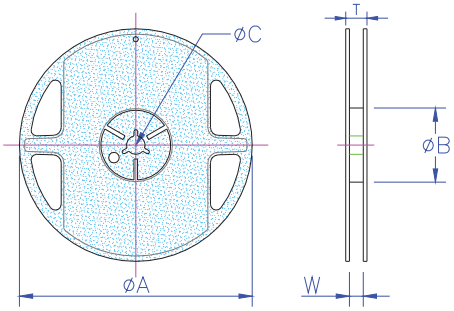
Item	Requirement	Test Method
Temperature Coefficient of Resistance (T.C.R.)	As specification	JIS-C-5201-1 4.8 IEC-60115-1 4.8 At 25°C/-55°C and 25°C/+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever 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

Item	Requirement	Test Method
Endurance	±(1.0%+0.05Ω)	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)	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)	JIS-C-5201-1 4.23 IEC-60115-1 4.23.2 at +155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once for 5 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage	JIS-C-5201-1 4.17 IEC-60115-1 4.17 245°C ±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260°C ±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°C ±5°C for 30 seconds
Rapid Change of Temperature	±(0.5%+0.05Ω)	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +155°C, 5 cycles

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

Packaging:

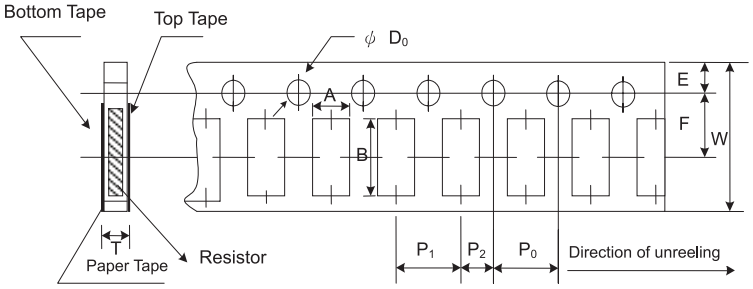
Reel Specifications & Packaging Quantity



Type	Packaging Quantity		Tape Width	Reel Diameter (Inches)	ØA	ØB	ØC	W	T
0402	Paper	10K	8mm	7 inch	178.5 ±1.5	$60^{+1/-0}$	13 ±0.2	9 ±0.5	12.5 ±0.5
0603	Paper	5K	8mm	7 inch	178.5 ±1.5	$60^{+1/-0}$	13 ±0.2	9 ±0.5	12.5 ±0.5
0805									
1206									
1210									
2010	Embossed	4K	12mm	7 inch	178.5 ±1.5	$60^{+1/-0}$	13 ±0.5	13 ±0.5	15.5 ±0.5
2512									

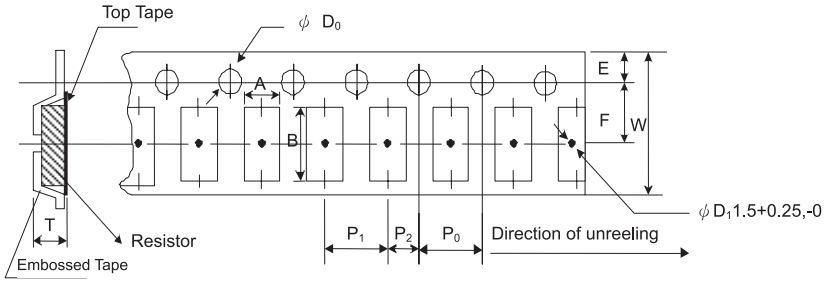
Dimensions : Millimetres

Paper Tape Specifications



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P_0 (mm)	P_1 (mm)	P_2 (mm)	$ØD_0$ (mm)	T (mm)
0402	0.65 ±0.1	1.15 ±0.1	8 ±0.2	1.75 ±0.1	3.5 ±0.05	4 ±0.1	2 ±0.05	2 ±0.05	1.5 +0.1,-0	0.45 ±0.1
0603	1.1 ±0.1	1.9 ±0.1	8 ±0.2	1.75 ±0.1	3.5 ±0.05	4 ±0.1	4 ±0.05	2 ±0.05	1.5 +0.1,-0	0.7 ±0.1
0805	1.6 ±0.1	2.4 ±0.2	8 ±0.2	1.75 ±0.1	3.5 ±0.05	4 ±0.1	4 ±0.05	2 ±0.05	1.5 +0.1,-0	0.85 ±0.1
1206	1.9 ±0.1	3.5 ±0.2	8 ±0.2	1.75 ±0.1	3.5 ±0.05	4 ±0.1	4 ±0.05	2 ±0.05	1.5 +0.1,-0	0.85 ±0.1
1210	2.9 ±0.1	3.5 ±0.2	8 ±0.2	1.75 ±0.1	3.5 ±0.05	4 ±0.1	4 ±0.05	2 ±0.05	1.5 +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)	$ØD_0$ (mm)	T (mm)
2010	2.8 ±0.1	5.5 ±0.1	12 ±0.3	1.75 ±0.1	5.5 ±0.05	4 ±0.1	4 ±0.1	2 ±0.05	1.5 +0.1, -0	1.2^{+0}
2512	3.5 ±0.1	6.7 ±0.1	12 ±0.3	1.75 ±0.1	5.5 ±0.05	4 ±0.1	4 ±0.1	2 ±0.05	1.5 +0.1, -0	1.2^{+0}

Marking

No Marking for 0402

0805 to 2512 4 Digits Marking For Example

Resistance	5.6Ω	97.6Ω	100Ω	2.2kΩ	10kΩ	49.9kΩ	100kΩ	1MΩ
Marking	5R60	97R6	1,000	2,201	1,002	4,992	1,003	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

1% for 0603: 3 Digits Marking in E96 (E96 Series Except E24 Series)

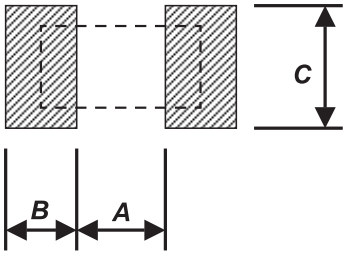
3 Digits Marking for Example: 13C = 13K3Ω 68B = 4K99Ω 68X = 49.9Ω

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

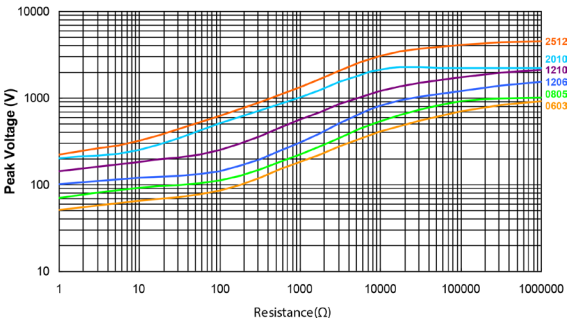


Type	A (mm)	B (mm)	C (mm)
0402	0.5	0.45	0.6
0603	0.9	0.6	0.9
0805	1.2	0.7	1.3
1206	2	0.9	1.6
1210	2	0.9	2.8
2010	3.8	0.9	2.8
2512	4.9	1	3.4

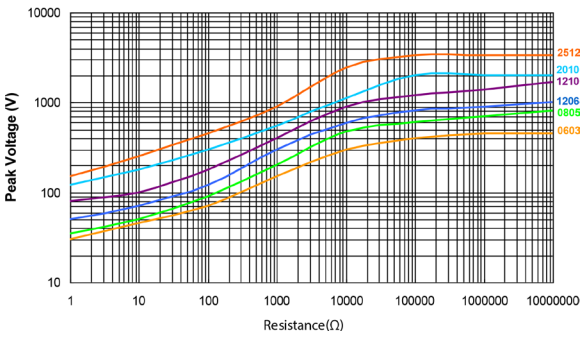
Lightning Surge

Resistors are tested in accordance with IEC 60 115-1 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.

MCPWR Series 1.2/50us Lightning Surge



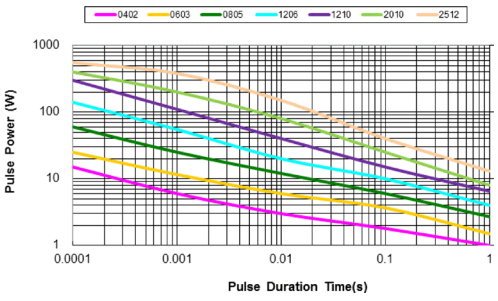
MCPWR Series 10/700us Lightning Surge



Pulse Withstanding Capacity

The single impulse graph is the result of 50 impulses of rectangular shape applied at one-minute intervals.
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.

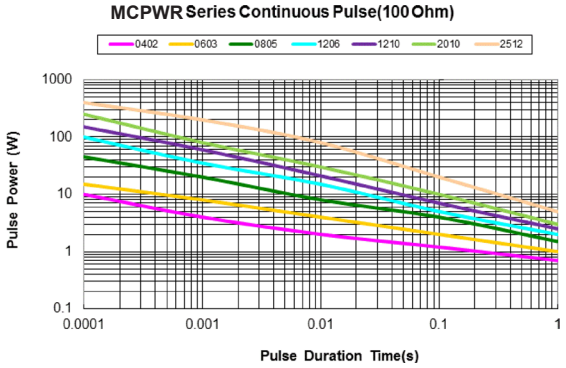
MCPWR Series Single Pulse(100 Ohm)

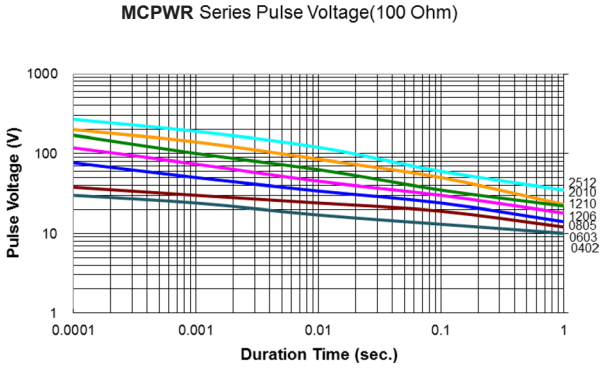


Chip Resistors
Pulse Withstanding

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.





Part Number Explanation

MCPWR	05	F	T	F	W	1001	N
Product Type	Dimensions	Resistance Tolerance	Packaging Code	TCR (PPM/°C)	Power Rating	Resistance	Marking

Dimensions	: 02 = 0402, 03 = 0603, 05 = 0805, 06 = 1206, 13 = 1210, 10 = 2010 and 12 = 2512
Resistance Tolerance	: D = ±0.5%, F = ±1%, J: ±5%
Packaging Code	: T = Taping Reel
TCR (PPM/°C)	: E = ±100, F = ±200, G: ±300
Power Rating	: 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 and P: 1/5W
Resistance	:1001 = 1kΩ, 1004 = 1MΩ
Marking	: Standard Marking, N = No Marking