

APPROVAL SHEET

Product Name : Thick Film Anti-Surge Chip Resistor

Part No. : TCG Series

Description : Size 0603~2512

Thick Film Anti-Surge Chip Resistor - TCG Series

■ Applications

- Power Supplies
- Telecommunication
- Medical Devices
- Measuring instrument



■ Features

- Excellent surge pulse capability
- Triple Power Rating

■ Part Number Explanation

TCG	0603	F	1001	T	S
Product	Size (Inch)	Tolerance	Resistance	Packaging	Functional
Thick Film Anti-Surge Chip Resistor	0603 0805 1206 1210 2010 2512	F : $\pm 1\%$ J : $\pm 5\%$	1 Ω =1R00 10 Ω =10R0 1K Ω =1001 1M Ω =1004	T= Tape & Reel	S=Standard P=High Power U=Ultra High Power M=Meet AEC-Q200

■ Standard Electrical Specifications

Item Type	Rated Power at 70℃	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/℃)	Resistance Range	
					F±(1%)	J(±5%)
TCG 0603	0.125 W	50V	100V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$
TCG 0805	0.25 W	150V	300V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$
TCG 1206	0.33 W	200V	400V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$
TCG 1210	0.5 W	200V	400V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$
TCG 2010	0.75 W	200V	400V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±150	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$
TCG 2512	1.5 W	300V	600V	±400	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 10\Omega$
				±150	$10\Omega \leq R \leq 1M\Omega$	$10\Omega \leq R \leq 1M\Omega$

• Functional code: S

• Beyond the above specification also can meet the special requirements. For detailed questions, please contact us freely.

■ High Power Rating Electrical Specifications

Item Type	Rated Power at 70°C	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/°C)	Resistance Range	
					F±(1%)	J(±5%)
TCG 0603	0.125 W	50V	100V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 1M\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	-
TCG 0805	0.25 W	150V	300V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 1M\Omega$
				±150	$1\Omega \leq R < 10\Omega$	-
				±100	$10\Omega \leq R \leq 1M\Omega$	-
TCG 1206	0.5 W	200V	400V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R \leq 1M\Omega$
				±100	$1\Omega \leq R \leq 1M\Omega$	-
TCG 1210	0.5 W	200V	400V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R \leq 1M\Omega$
				±100	$1\Omega \leq R \leq 1M\Omega$	-
TCG 2010	1 W	200V	400V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R \leq 1M\Omega$
				±100	$1\Omega \leq R \leq 1M\Omega$	-
TCG 2512	2 W	300V	600V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R \leq 1M\Omega$
				±100	$1\Omega \leq R \leq 1M\Omega$	-

• Functional code: P

• Beyond the above specification also can meet the special requirements. For detailed questions, please contact us freely.

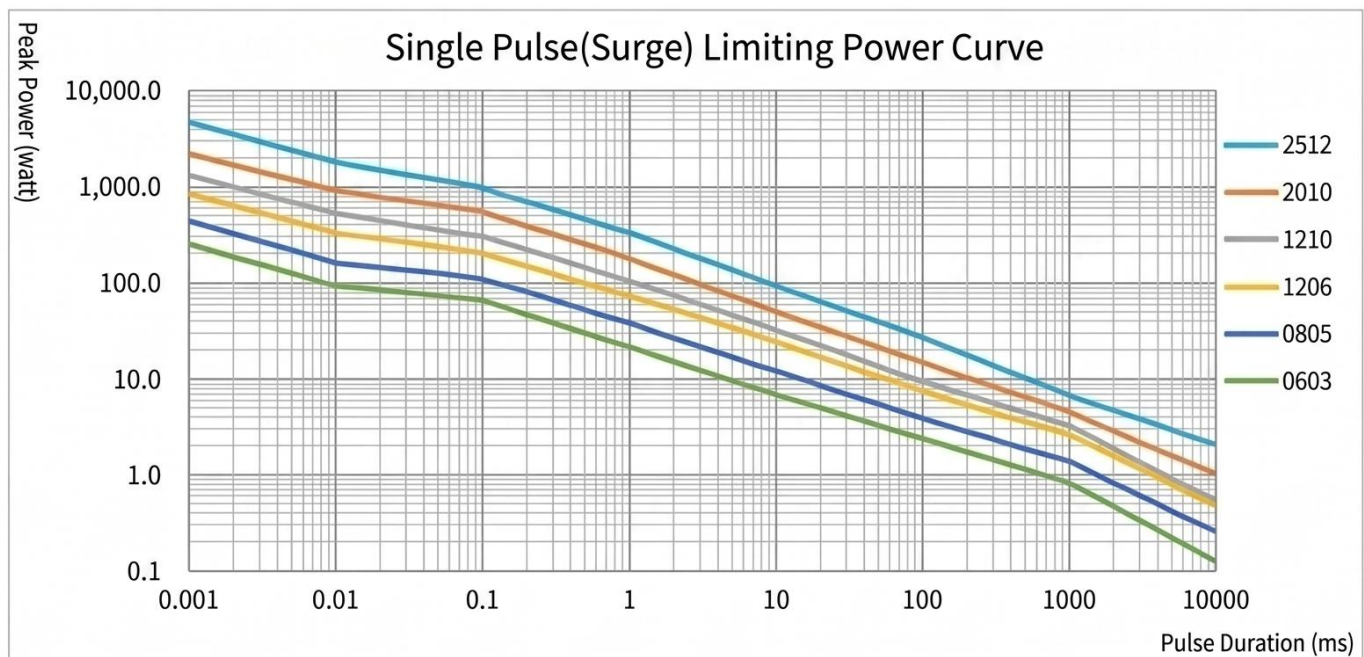
■ Ultra High Power Rating Electrical Specifications

Item Type	Rated Power at 70°C	Max Working Voltage	Max Overload Voltage	T.C.R. (PPM/°C)	Resistance Range	
					F±(1%)	J(±5%)
TCG 0603	0.33 W	75V	125V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 1M\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	-
TCG 0805	0.5 W	200V	300V	±200	-	$1\Omega \leq R < 1M\Omega$
				±150	$1\Omega \leq R < 10\Omega$	-
				±100	$10\Omega \leq R \leq 1M\Omega$	-
TCG 1206	0.75 W	250V	500V	±200	$1\Omega \leq R < 10\Omega$	$1\Omega \leq R < 1M\Omega$
				±100	$10\Omega \leq R \leq 1M\Omega$	-

• Functional code: U

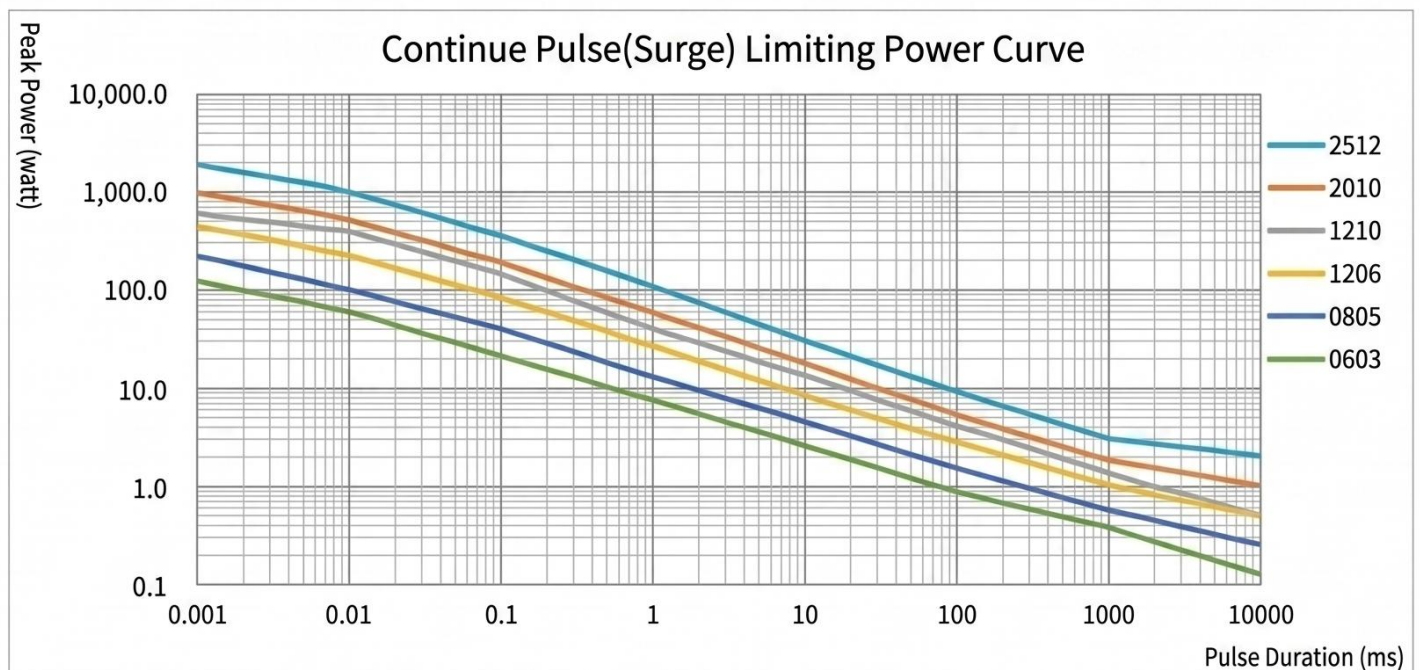
• Beyond the above specification also can meet the special requirements. For detailed questions, please contact us freely.

Surge Performance



Note:

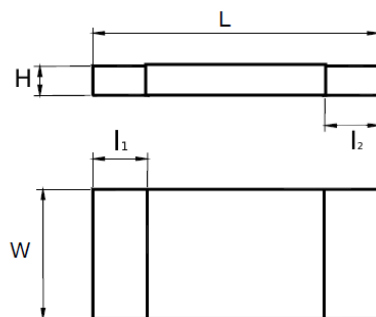
1. Due to application variation, the pulse endurance values are not assured. Please evaluate the products on actual use them.
2. 10 rectangular pulses amplitude are applied to the component at intervals of 60 seconds, permissible the resistance to be varied by a(1% R~0.010%).
3. Pulse duration over 10 seconds use the resistor's rated power for evaluate.



Note:

1. Due to application variation, the pulse endurance so values are not assured. Please evaluate the products on actual user them.
2. 10 rectangular pulses applicable for no exceed P_N loading with variant duty ratio.
3. Pulse duration over 10 seconds tested, permissible the resistance te varied by z(1% R> 0.01D).

■ Dimension



Unit: mm

Size	L	W	H	l ₁	l ₂
0603	1.60 ±0.10	0.80 ±0.10	0.45 ±0.10	0.30 ±0.20	0.30 ±0.20
0805	2.00 ±0.10	1.25 ±0.10	0.50 ±0.10	0.40 ±0.20	0.40 ±0.20
1206	3.10 ±0.10	1.60 ±0.10	0.55 ±0.10	0.50 ±0.25	0.50 ±0.25
1210	3.10 ±0.10	2.60 ±0.10	0.55 ±0.10	0.50 ±0.25	0.50 ±0.25
2010	5.00 ±0.20	2.50 ±0.20	0.60 ±0.10	0.65 ±0.25	0.60 ±0.25
2512	6.40 ±0.20	3.10 ±0.20	0.60 ±0.15	0.60 ±0.25	1.80 ±0.25

■ Recommend Land Pattern Design

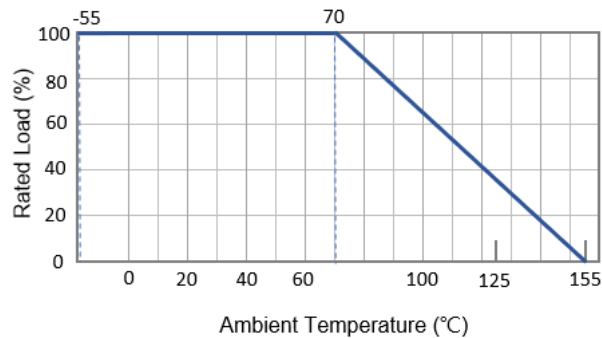


Unit: mm

Item \ Type	0603	0805	1206	1210	2010	2512
D	1.00	1.15	1.30	1.30	1.50	2.45
L	3.00	3.50	4.70	4.70	6.80	7.60
W	0.90	1.30	1.80	3.00	3.00	3.70

■ Power Derating Curve

Operating Temperature Range: -55 to +155°C



■ Voltage Rating or Current Rating

Resistance Range: $\geq 1\Omega$

Rated Voltage: The resistor shall have a DC continuous working voltage or a RMS AC continuous working voltage at commercial-line frequency and wave form corresponding to the power rating, as determined formula as following:

$$E(RCWV) = \sqrt{P \times R}$$

E=Rated voltage(V)

P=Power rating(W)

R=Nominal resistance(Ω)

■ Reliability Test and Requirement - AEC-Q200

Test Item	Test Method	Procedure	Requirements
High Temperature Exposure (Storage)	AEC-Q200 7.3	1000 hrs. @ T=155°C. Unpowered. Measurement at 24 ±2 hours after test conclusion.	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.05\Omega)$
Temperature Cycling	AEC-Q200 7.4	1000 Cycles (-55°C to +125°C). Measurement at 24±2 hours after test conclusion.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.
Moisture Resistance	AEC-Q200 7.6	Test 65°C/80~100%RH/10Cycles. Measurement at 24±2 hours after test conclusion. (t=24hrs/cycle).	J : $\Delta R \leq \pm(1\%+0.1\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$
Biased Humidity	AEC-Q200 7.7	1000 hours 85°C/85%RH. 10% of operating power. Measurement at 24 ±2 hours after test conclusion.	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.05\Omega)$
Operational Life	AEC-Q200 7.8	Test 1000hr @ T=125°C at specified rated power. Measurement at 24±2 hours after test conclusion.	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.05\Omega)$
External Visual	AEC-Q200 7.9	Inspect device construction, marking and workmanship.	No visual damage and refer Ridee marking code.
Physical Dimension	AEC-Q200 7.10	Verify physical dimensions to the applicable device detail specification.	Within the spec.
Mechanical Shock	AEC-Q200 7.13	Test Peak value: 100g's, Wave: Half-sine, Duration: 6ms, Velocity: 12.3ft/sec.	Within product specification tolerance and no visible damage.
Vibration	AEC-Q200 7.14	5 g's for 20 min., 12 cycles each of 3 orientations. Test from 10-2000 Hz.	No mechanical damage.
Resistance to Soldering Heat	AEC-Q200 7.15	270°C±5°C for 10sec.±1sec.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.
Thermal Shock	AEC-Q200 7.16	-55 to 155°C/ dwell time 15min/ Max transfer time 20sec/ 300cycles.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.
ESD	AEC-Q200-002	Test contact min. 1KV.	$\Delta R \leq \pm(1\% + 0.1\Omega)$ No mechanical damage.
Solderability	AEC-Q200 7.18	a) Baking 155°C4H, dipping 235°C5s b) Steam 1H, dipping 215°C5s c) Steam 1H, dipping 260°C7s	Over 95% of termination must be covered with solder.
Flammability	AEC-Q200 7.20	UL-94 V-0 or V-1 are acceptable	Refer UL-94.
Bending Strength	AEC-Q200 7.21	Bending 2mm 2512.2010.1210.1206, 3mm 0805.0603.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.

Terminal Strength	AEC-Q200 7.22	Force 1Kg for 60 seconds	No mechanical damage
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	5 × Rated power for 5 seconds	J : $\Delta R \leq \pm(2\% + 0.1\Omega)$ F : $\Delta R \leq \pm(1\% + 0.05\Omega)$
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	Temperature: (T1. +25°C) ~ (T2. +155°C) TCR(ppm/°C) = (R2-R1)/R1×1/(T2-T1)×10 ⁶ (+25~ -55°C please contact factory)	As Spec

■ Reliability Test and Requirement - Standard

Test Item	Test Method	Procedure	Requirements
Temperature Coefficient of Resistance (T.C.R)	JIS-C-5201-1 4.8 IEC-60115-1 4.8	Temperature: (T1. +25°C) ~ (T2. +155°C) TCR(ppm/°C) = (R2-R1)/R1×1/(T2-T1)×10 ⁶ (+25~ -55°C please contact factory)	As Spec
Short Time Overload	JIS-C-5201-1 4.13 IEC-60115-1 4.13	5 × Rated power for 5 seconds	J : $\Delta R \leq \pm(2\% + 0.1\Omega)$ F : $\Delta R \leq \pm(1\% + 0.05\Omega)$
Resistance to Soldering Heat. (R.S.H)	JIS-C-5201-1 4.18 IEC-60115-1 4.18	260±5°C for 10 seconds.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$
Temperature Cycling	JIS-C-5201-1 4.19 IEC-60115-1 4.19	Repeat 5 cycles as follows-55°C(30 min.) + 25°C(2~3 min.) +155°C(30 min.) + 25°C(2~3 min.)	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.
Damp Heat	JIS-C-5201-1 4.24 IEC-60115-1 4.24	Maintain the temperature of the resistor at 40±2°C and 90~95% R.H. with the rated voltage applied.Cycle ON for 1.5 hours and OFF for 0.5 hour for 1000+48/-0 hours. After 1~4 hour, measure the resistance value.	J : $\Delta R \leq \pm(3\% + 0.1\Omega)$ F : $\Delta R \leq \pm(1\% + 0.05\Omega)$
Load Life	JIS-C-5201-1 4.25 IEC-60115-1 4.25.	Permanent resistance change after 1000+48/-0 hours (1.5 hours ON , 0.5 hour OFF) at RCWV or Max. Keep the resistor at 70±2°C ambient"	J : $\Delta R \leq \pm(3\% + 0.1\Omega)$ F : $\Delta R \leq \pm(1\% + 0.05\Omega)$
Insulation Resistance	JIS-C-5201-1 4.6 IEC-60115-1 4.6	Apply the maximum overload voltage (DC) for 1minute	$\Delta R \geq 10G\Omega$
Bending Strength	JIS-C-5201-1 4.33 IEC-60115-1 4.33	Bending 2mm 2512.2010.1210.1206, 3mm 0805.0603.	J : $\Delta R \leq \pm(1\% + 0.1\Omega)$ F : $\Delta R \leq \pm(0.5\% + 0.05\Omega)$ No mechanical damage.
Solderability	JIS-C-5201-1 4.17 IEC-60115-1 4.17	After immersing flux, dip in the 245±2°C molten solder bath for 3±0.5 sec	Over 95% of termination must be covered with Solder

■ Recommended Customer Soldering Parameters

■ Recommended IR Reflow Soldering Conditions

Preliminary heating: 150°C~180°C, 120s max

Soldering: 220°C, 60s max

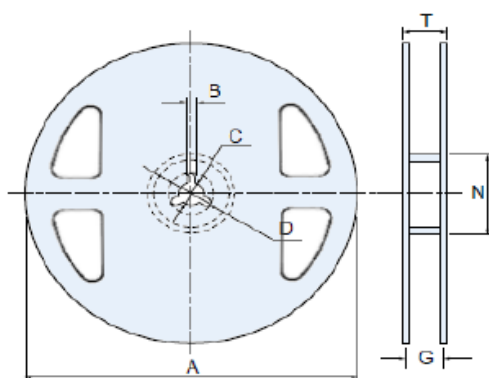
Peak temperature: 260°C, 10s max

■ Recommended WAVE Soldering Conditions

Reservoir Temperature: 260°C, 10s max

Number of times: two times max

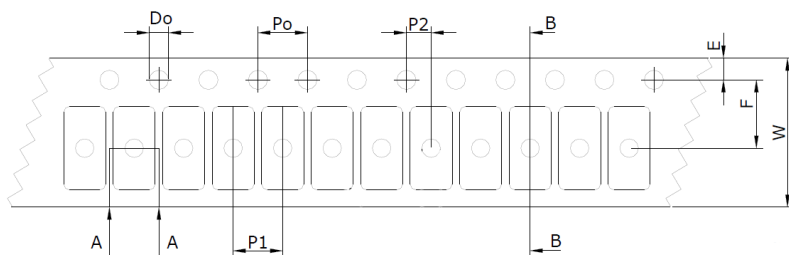
■ Packaging Information



Unit: mm

Unit: mm									
Size	Type		A	N	C	D	B	G	T
0603 / 0805 / 1206 / 1210	7"	5K/Reel	178±2.0	60.0±0.5	13.0±0.5	20min	2.0±0.5	10.0±1.5	14.9 max
2010/2512	7"	4K/Reel	178±2.0	60.0±0.5	13.0±0.5	20min	2.0±0.5	13.8±1.5	16.7 max.

■ Tapping Specification



Unit:mm

Packaging	Size	A	B	W	E	F	P1	P2	D0	P0
Paper Type	0603	1.10±0.20	1.90±0.20	8.00±0.30	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10
	0805	1.65±0.20	2.40±0.20	8.00±0.30	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10
	1206	2.00±0.20	3.60±0.20	8.00±0.30	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10
	1210	3.00±0.20	3.60±0.20	8.00±0.30	1.75±0.10	3.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10

Packaging	Size	A	B	W	E	F	P1	P2	D0	P0
Embossed Type	2010	2.80±0.20	5.50±0.20	12.00±0.30	1.75±0.10	5.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10
	2512	3.50±0.20	6.70±0.20	12.00±0.30	1.75±0.10	5.50±0.05	4.00±0.10	2.00±0.05	1.50+0.10/-0	4.00±0.10

■ Marking

■ E96, E24 ±1%: 4 digits marking for 0805/1206/1210/2010/2512

Resistance	120KΩ
4 digits code	1203

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

Resistance	120KΩ
3 digits code	124

■ E24 ±1%: 3 digits marking for 0603

Resistance	2.2KΩ
3 digits code	222

■ E96 ±1%: 3 digits marking for 0603

Resistance	1KΩ
3 digits code	01B