

FrelTec GmbH

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High Voltage Chip Resistors SMD

SMD

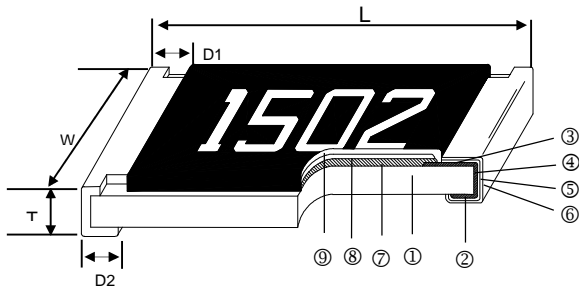
SPECIFICATION

Part
Number

033	05*	1001*	J*	T05*	F	D
Type	Size	Value	Tolerance	Packing	TCR	Power Rating
033 : SMD High Voltage Thick Film Chip Resistor	02 : 0402	R=Decimal	F : $\pm 1\%$	T05: Tape and reel for 5k pc (10"reel for 0603 to 1206),	F : $\pm 100\text{ppm}/$ $^{\circ}\text{C}$	B: 1/16W
	03 : 0603	The last digit is the multiplier	J : $\pm 5\%$	T10: Tape and reel for 10k pc 7"reel for 0402	G : $\pm 200\text{ppm}/$ $^{\circ}\text{C}$	C: 1/10W
	05 : 0805	which denotes the number of zero following		E04: Embossed reel for 4k pc 7"reel for 2010 and 2512	I : $\pm 400\text{ppm}/$ $^{\circ}\text{C}$	D: 1/8W
	06 : 1206	0000=0Ohm				R: 1/6W
	20 : 2010	Example:		10" and 13" reels upon request		E: 1/4W
	25 : 2512	97R6= 97,6 Ohm 9760 = 976Ohm 1001 = 1kOhm				H: 1/2W J: 1W
		E24-Series is first digit "0"			* not all combination is possible	

All products according to RoHS (2011/65/EU)

SMD THICK FILM CHIP RESISTORS



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

Dimensions

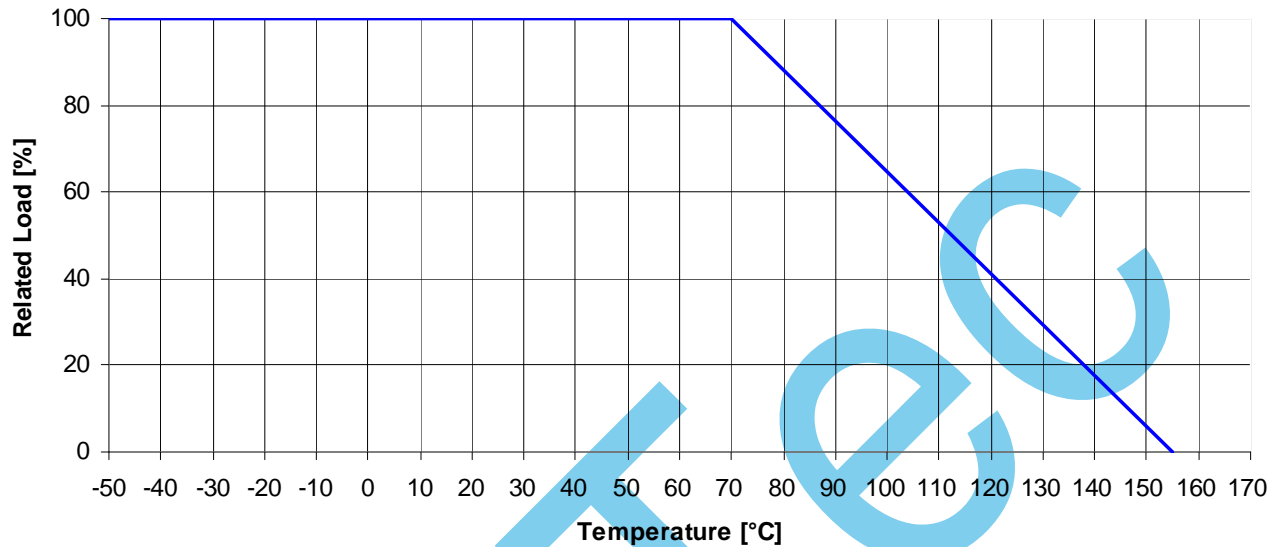
SIZE	L	W	T	D ₁	D ₂
0402	1,00±0,05	0,50±0,05	0,35±0,05	0,20±0,10	0,20±0,10
0603	1,60±0,10	0,80±0,10	0,45±0,10	0,30±0,20	0,30±0,20
0805	2,00±0,10	1,25±0,10	0,50±0,10	0,35±0,20	0,40±0,20
1206	3,10±0,10	1,55±0,10	0,55±0,10	0,50±0,25	0,50±0,20
2010	5,00±0,10	2,50±0,15	0,55±0,10	0,60±0,25	0,50±0,20
2512	6,35±0,10	3,10±0,15	0,55±0,10	0,60±0,25	0,50±0,20

(unit: mm)

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Power Derating Curve:

For resistors operated in ambient temperatures above 70°C, power rating must be derated in accordance with the curve below. Operating temperature -55°C to +155°C



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.

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THICK FILM CHIP RESISTORS

*Rating***033 Series**

GENERAL PURPOSE CHIP RESISTORS

Item Size	Power Rating at 70°C	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	TCR (ppm/°C)	Resistance Range	
						±1% (E96-serie)	±5% (E24-serie)
0402	1/16W	-55 ~ +155°C	100V	200V	±100	39kΩ - 1MΩ	
					±200	1.02MΩ - 10MΩ	1.1MΩ - 20MΩ
					±400	-	22MΩ - 100MΩ
0603	1/10W		200V	400V	±100	56kΩ - 1MΩ	
					±200	1.02MΩ - 10MΩ	1.1MΩ - 20MΩ
					±400	-	22MΩ - 100MΩ
0805	1/8W		400V	800V	±100	100kΩ - 1MΩ	
					±200	1.02MΩ - 10MΩ	1.1MΩ - 20MΩ
					±400	-	22MΩ - 100MΩ
1206	1/4W		500V	1000V	±100	100kΩ - 1MΩ	
					±200	1.02MΩ - 10MΩ	1.1MΩ - 20MΩ
					±400	-	22MΩ - 100MΩ
2010	1/2W	2000V	3000V	±100	51kΩ - 1MΩ		
				±200	1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	
				±400	-	22MΩ - 100MΩ	
2512	1W	3000V	4000V	±100	30kΩ - 1MΩ		
				±200	1,02MΩ - 20MΩ	1,1MΩ - 20MΩ	
				±400	-	22MΩ - 100MΩ	

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SPECIFICATION



0402 no marking

E96 (1%) 0805 to 2512

4 digit marking, first three digits marking are significant figures; forth digit is multiplier (10^X).

examples: 1542 = 154x10²=15.400 Ohm=15,4kOhm



E24 (5%) 0603 to 2512

3 digit marking, first two digits marking are significant figures; third digit is multiplier (10^X).

examples: 512 = 51x10² = 5,1kOhm



E96 (1%) 0603

examples: 12C (Table below) = 130x10² = 13kOhm, 000 = 0 Ohm

3 digit 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

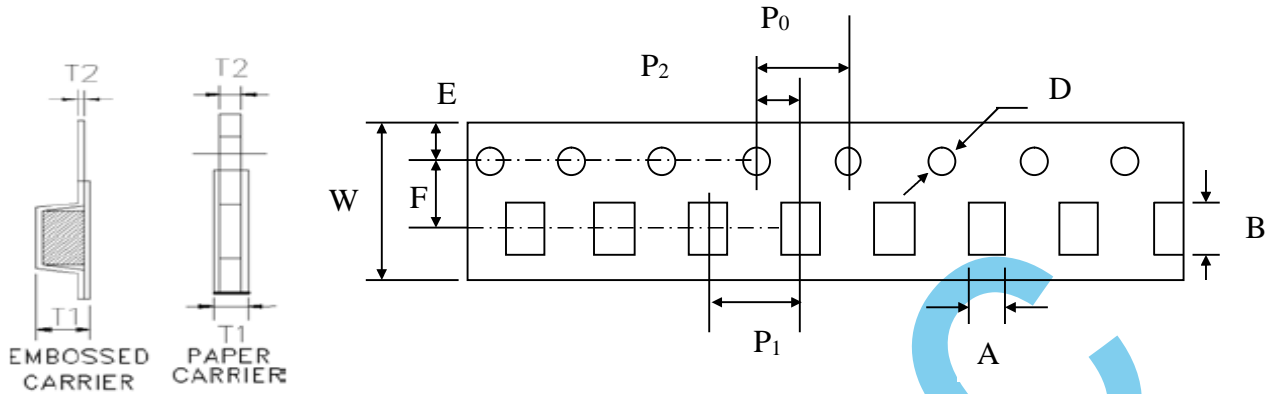
Code	A	B	C	D	E	F	G	H	X	Y	Z
Multiplier	10 ⁰	10 ¹	10 ²	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁻¹	10 ⁻²	10 ⁻³

E24	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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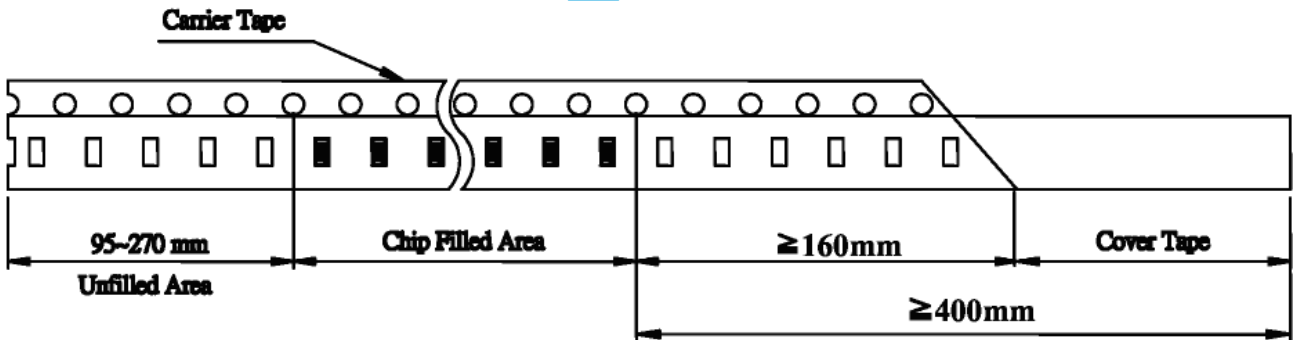
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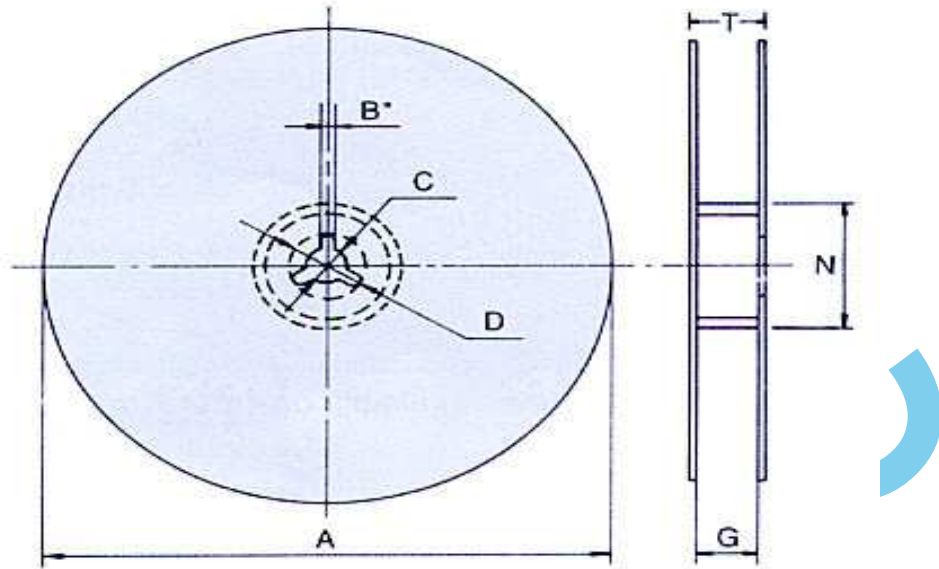
Tape And Reel Package



Packing	Size	A	B	W	F	E	P ₁	P ₂	P ₀	D	T ₁
Paper Tape	0402	0,65±0,10	1,15±0,1	8,0±0,2	3,50±0,05	1,75±0,10	2,00±0,05	2,00±0,05	4,00±0,10	1,50+0,1/-0	0,45±0,1
	0603	1,10±0,10	1,90±0,1	8,0±0,2	3,50±0,05	1,75±0,10	4,00±0,05	2,00±0,05	4,00±0,10	1,50+0,1/-0	0,70±0,1
	0805	1,60±0,10	2,40±0,2	8,0±0,2	3,50±0,05	1,75±0,10	4,00±0,05	2,00±0,05	4,00±0,10	1,50+0,1/-0	0,85±0,1
	1206	1,90±0,10	3,50±0,2	8,0±0,2	3,50±0,05	1,75±0,10	4,00±0,05	2,00±0,05	4,00±0,10	1,50+0,1/-0	0,85±0,1
Embossed Plastic Tape	2010	2,8±0,10	5,5±0,10	12,0±0,3	5,5±0,05	1,75±0,10	4,00±0,1	2,00±0,05	4,00±0,10	1,50+0,1, -0	1,2 ⁺⁰
	2025	3,5±0,10	6,7±0,10	12,0±0,3	5,5±0,05	1,75±0,10	4,00±0,1	2,00±0,05	4,00±0,10	1,50+0,1, -0	1,2 ⁺⁰

Lead Dimensions:





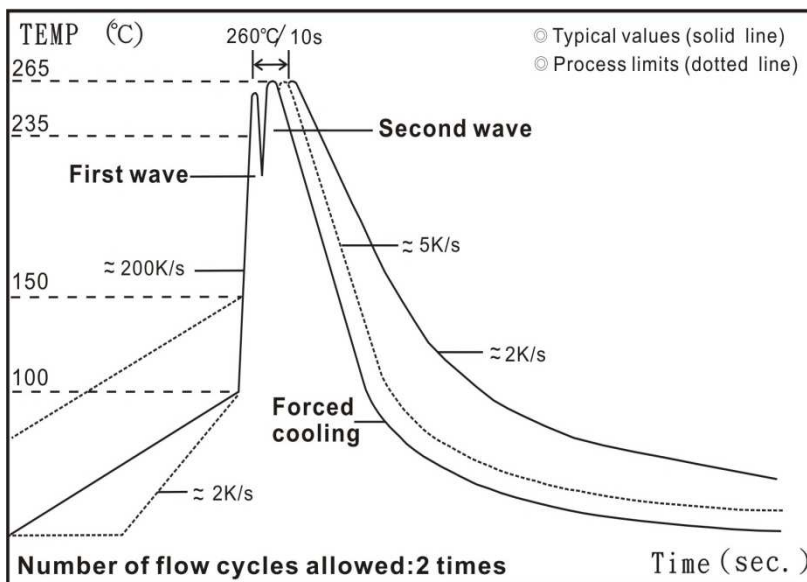
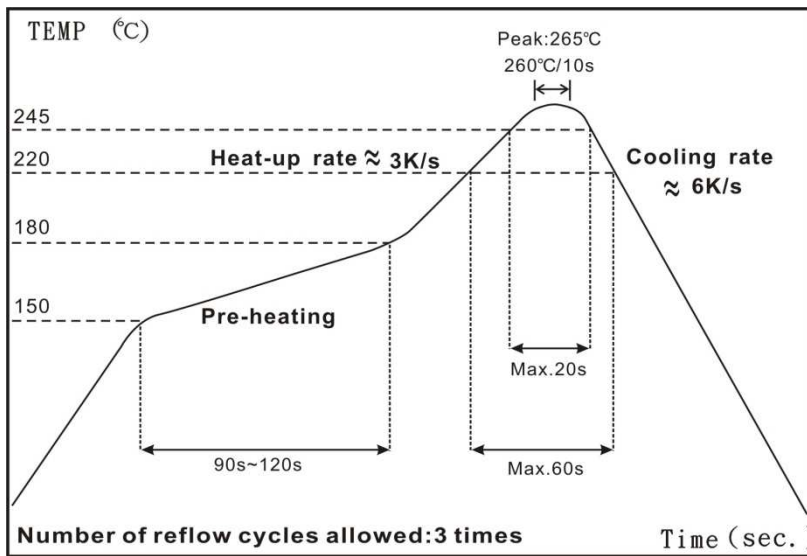
Symbol	Reel Type / Tape	A	N	C	T	G
Dimension	7" reel	178,5±1,5	60,0+1-0	13,0±0,2	12,5±0,5	9,0±0,5
	10" reel	254±10	100,0±0,5		13,5±0,5	9,5±0,5
	13" reel	330±1	100,0±0,5		13,5±0,5	9,5±0,5
	7" reel	178,5±1,5	60,0+1-0	13,0±0,5	15,5±0,5	13,0±0,5
	10" reel	250±1	62,0±0,5		16,5±0,5	12,5±0,5

in mm

Stock period

The performance of these products, including the solderability, is guaranteed for 12 month after production date code, provided that they remain packed as they were when delivered and stored at a temperature of 25°C ± 3°C and a relative humidity less than 80%RH

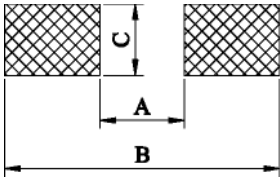
Lead Free Reflow Soldering Profile



- (1) Time of IR reflow soldering at maximum temperature point 260°C: 10s
- (2) Time of wave soldering at maximum temperature point 260°C: 10s
- (3) Time of soldering iron at maximum temperature point 410°C: 5s

SMD Resistors

Recommended Land Pattern Design (For Reflow Soldering):



Size	A	B	C
0402	0,5	1,4	0,6
0603	0,9	2,1	0,9
0805	1,2	2,6	1,3
1206	2,0	3,8	1,6
2010	3,8	5,6	2,8
2512	3,8	7,0	3,5

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Resistors

Environmental Characteristics

Item	Requirement		Test Method
	1%	5%	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.		JIS C 5201-1 4.8 IEC 60115-1 4.8 -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(1,0%+0,05Ω)	±(2,0%+0,05Ω)	JIS C 5201-1 4.13 IEC 60115-1 4.13 2,5 times RCWV or Max. overload voltage for 5 seconds, whichever is lower for 5 sec
Insulation Resistance	≥10G		JIS C 5201-1 4,6 IEC 60115-1 4,6 Max, overload voltage for 1 minute
Endurance	±(2,0%+0,10Ω)	±(3,0%+0,10Ω)	JIS C 5201-1 4.25 IEC 60115-1 4.25.1 70±2°C, Max. working voltage for 1000 hrs with 1,5 hrs "ON" and 0,5 hrs "OFF"
Damp Heat with Load	±(2,0%+0,10Ω)	±(3,0%+0,10Ω)	JIS C 5201-1 4.24 IEC 60115-1 4.24 40±2°C, 90~95% R.H., Max. working voltage for 1000 hrs with 1.5 hrs "ON" and 0,5 hrs "OFF"
Dry Heat	±(1,0%+0,05Ω)	±(1,5%+0,10Ω)	JIS C 5201-1 4.23.2 IEC 60115-1 2.23.2 at +155°C for 1000 hrs
Bending Strength	±(1,0%+0,05Ω)	±(1,0%+0,05Ω)	JIS C 5201-1 4.33 IEC 60115-1 4.33 Bending once for 5 seconds with 3mm 2010 2512 sizes: 2 mm
Solderability	>95% 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)	±(1,0%+0,05Ω)	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 HVR02: 150V for 1 minute HVR03: 300V for 1 minute HVR05/HVR06/HVR0A/HVR12: 500V 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
Rapid Change of Temperature	±(0,5%+0,05Ω)	±(1,0%+0,05Ω)	JIS C 5201-1 4.19 IEC 60115-1 4.19 -55°C to +155°C, 5 cycles

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