

Features:

- Accurate fusibility applicable to safety circuits in a wide range of electronic sets
- Small size and light weight
- Reliability and high quality
- Low temperature coefficient (under ± 600 ppm/ $^{\circ}\text{C}$)
- RoHS compliant, REACH compliant, and halogen free



Electrical Specifications					
Type/Code	Power Rating @ 70°C (W)	Maximum Working Voltage (V) ⁽¹⁾	Fusing Time and Min. Fusing Power	TCR (ppm/ $^{\circ}\text{C}$)	Ohmic Range (Ω) and Tolerance
					1%, 5%
FRC0402	0.063	50	< 30 seconds at 2.5W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1K
FRC0603	0.1	100	< 30 seconds at 3W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K
FRC0805	0.125	150	< 30 seconds at 3.25W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K
FRC1206	0.25	200	< 30 seconds at 5W	± 800	0.47 - 0.976
				± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K
FRC1210	0.5	250	< 30 seconds at 7.5W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K
FRC2010	0.75	300	< 30 seconds at 11.25W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K
FRC2512	1	400	< 30 seconds at 15W	± 600	1 - 47
				± 400	47.5 - 470
				± 200	475 - 1.8K

(1) Lesser of $\sqrt{P \cdot R}$ or maximum working voltage.

Operating Temperature Range: -55 ~ +155°C

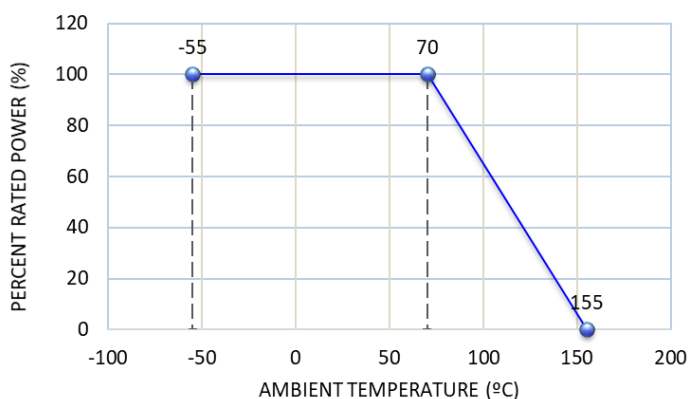
Contact Stackpole for non-standard parts.

Mechanical Specifications						
Type/Code	L	W	H	I1	I2	Unit
FRC0402	0.039 $\pm$ 0.004	0.020 $\pm$ 0.002	0.012 $\pm$ 0.002	0.006 $\pm$ 0.004	0.008 $\pm$ 0.004	inches
	1.00 $\pm$ 0.10	0.50 $\pm$ 0.05	0.30 $\pm$ 0.05	0.15 $\pm$ 0.10	0.20 $\pm$ 0.10	mm
FRC0603	0.063 $\pm$ 0.008	0.031 $\pm$ 0.006	0.016 $\pm$ 0.004	0.012 $\pm$ 0.008	0.012 $\pm$ 0.004	inches
	1.60 $\pm$ 0.20	0.80 $\pm$ 0.15	0.40 $\pm$ 0.10	0.30 $\pm$ 0.20	0.30 $\pm$ 0.10	mm

Mechanical Specifications (cont.)

Type/Code	L	W	H	I1	I2	Unit
FRC0805	0.079 ± 0.008 2.00 ± 0.20	0.049 ± 0.006 1.25 ± 0.15	0.020 ± 0.006 0.50 ± 0.15	0.012 ± 0.006 0.30 ± 0.15	0.016 ± 0.006 0.40 ± 0.15	inches mm
FRC1206	0.120 ± 0.010 3.05 ± 0.10	0.063 ± 0.010 1.60 ± 0.20	0.022 ± 0.006 0.55 ± 0.15	0.016 ± 0.008 0.40 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm
FRC1210	0.120 ± 0.004 3.05 ± 0.10	0.098 ± 0.008 2.50 ± 0.20	0.022 ± 0.006 0.55 ± 0.15	0.020 ± 0.008 0.50 ± 0.20	0.020 ± 0.008 0.50 ± 0.20	inches mm
FRC2010	0.197 ± 0.008 5.00 ± 0.20	0.098 ± 0.008 2.50 ± 0.20	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm
FRC2512	0.248 ± 0.008 6.30 ± 0.20	0.126 ± 0.008 3.20 ± 0.20	0.022 ± 0.004 0.55 ± 0.10	0.024 ± 0.008 0.60 ± 0.20	0.024 ± 0.008 0.60 ± 0.20	inches mm

Power Derating Curve:

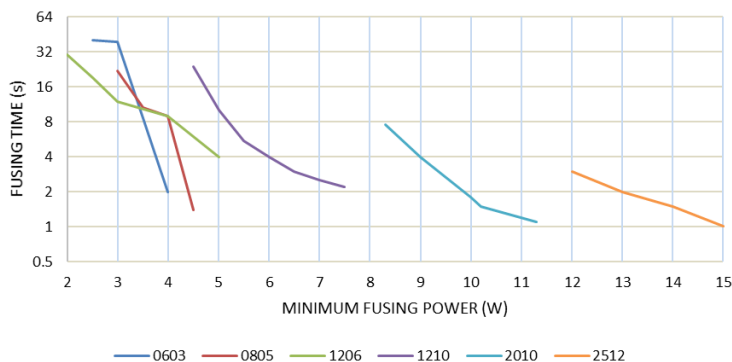


Performance Characteristics

Test	Test Method	Test Specification	Test Condition
Temperature Coefficient of Resistance (T.C.R.)	JIS C 5201-1 clause 4.8	Refer to Electrical Specification table	- 55/+155°C, 25°C is the reference temperature
Short Time Overload	JIS C 5201-1 clause 4.13	1%: ± (1% + 0.05Ω) 5%: ± (2% + 0.1Ω)	General: 2.5 times RCWV or Max. Overload Voltage whichever is less for 5 seconds
Soldering Heat	JIS C 5201-1 clause 4.18	1%: ± (0.5% + 0.05Ω) 5%: ± (1% + 0.05Ω)	260 ± 5°C for 10 seconds
Temperature Cycling	JIS C 5201-1 clause 4.19	1%: ± (0.5% + 0.05Ω) 5%: ± (1% + 0.1Ω)	- 55 to + 155°C, 5 cycles
Resistance to Solvent	JIS C 5201-1 clause 4.29	± (0.5% + 0.05Ω)	The tested resistor shall be immersed into isopropyl alcohol at 20 ~ 25°C for 60 seconds. Then the resistor is left in the room for 48 hours.
Load Life in Humidity	JIS C 5201-1 clause 4.24	1%: ± (1% + 0.05Ω) 5%: ± (2% + 0.05Ω)	40 ± 2°C, 90% ~ 95% R.H. RCWV or Max. Working Voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"
Load Life (Endurance)	JIS C 5201-1 clause 4.25	1%: ± (1% + 0.05Ω) 5%: ± (3% + 0.1Ω)	70 ± 2°C, RCWV or Max. Working Voltage whichever is less for 1000 hours with 1.5 hours "ON" and 0.5 hour "OFF"
Insulation Resistance	JIS C 5201-1 clause 4.6	≥ 10GΩ	100 V for 1 minute
Terminal Bending Strength	JIS C 5201-1 clause 4.33	± (1% + 0.05Ω)	Bending once for 5 seconds. 0402, 0603, 0805 = 5 mm 1206, 1210 = 3 mm 2010, 2512 = 2 mm

Recommended storage conditions: Temperature of 25 ± 5°C. Humidity: 60% ± 20% R.H..

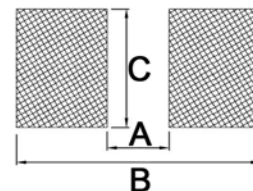
Example of Fusing Characteristics



Because fusing time is related to position and mounting of the part, copper in the PCB, solder pad size and solder amount, and other variables, this information is only a reference point. Applications using this and any fusing element should verify if the fusing characteristic is adequate.

Recommended Pad Layout

Type/Code	A	B	C	Unit
FRC0402	0.024 0.60	0.063 1.60	0.028 0.70	inches mm
FRC0603	0.031 0.80	0.094 2.40	0.039 1.00	inches mm
FRC0805	0.051 1.30	0.114 2.90	0.057 1.45	inches mm
FRC1206	0.087 2.20	0.165 4.20	0.071 1.80	inches mm
FRC1210	0.079 2.00	0.173 4.40	0.106 2.70	inches mm
FRC2010	0.150 3.80	0.260 6.60	0.106 2.70	inches mm
FRC2512	0.193 4.90	0.319 8.10	0.134 3.40	inches mm



Recommended Solder Profile

This information is intended as a reference for solder profiles for Stackpole resistive components. These profiles should be compatible with most soldering processes. These are only recommendations. Actual numbers will depend on board density, geometry, packages used, etc., especially those cells labeled with “*”.

100% Matte Tin / RoHS Compliant Terminations

Soldering iron recommended temperatures: 330 to 350°C with minimum duration.
Maximum number of reflow cycles: 3.

Wave Soldering

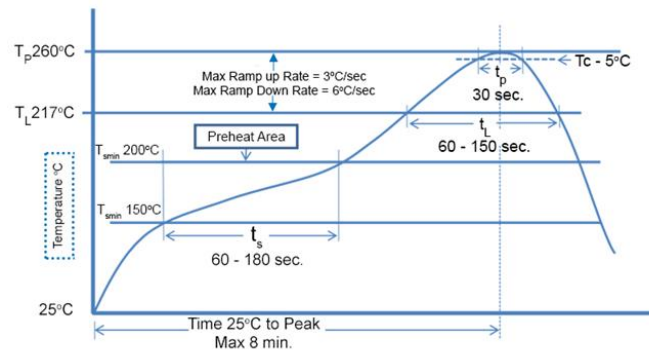
Description	Maximum	Recommended	Minimum
Preheat Time	80 seconds	70 seconds	60 seconds
Temperature Diff.	140°C	120°C	100°C
Solder Temp.	260°C	250°C	240°C
Dwell Time at Max.	10 seconds	5 seconds	*
Ramp DN (°C/sec)	N/A	N/A	N/A

Temperature Diff. = Difference between final preheat stage and soldering stage.

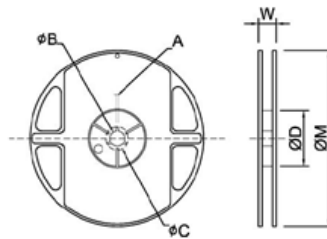
Convection IR Reflow

Description	Maximum	Recommended	Minimum
Ramp Up (°C/sec)	3°C/sec	2°C/sec	*
Dwell Time > 217°C	150 seconds	90 seconds	60 seconds
Solder Temp.	260°C	245°C	*
Dwell Time at Max.	30 seconds	15 seconds	10 seconds
Ramp DN (°C/sec)	6°C/sec	3°C/sec	*

Recommended Lead Free Resistor Reflow Profile

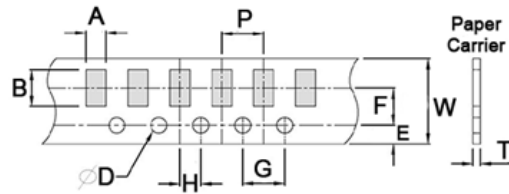


Reel Specifications



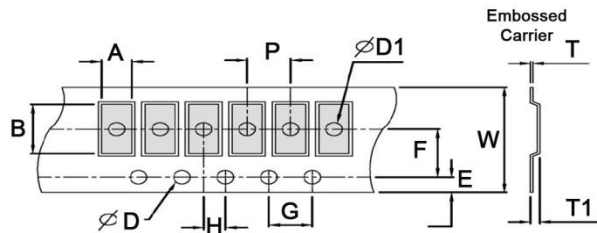
Type/Code	A	B	C	D	W	M	Unit
FRC0402	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.004 11.50 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC0603	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.004 11.50 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC0805	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.004 11.50 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC1206	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.004 11.50 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC1210	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.453 ± 0.004 11.50 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC2010	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.630 ± 0.004 16.00 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm
FRC2512	0.079 ± 0.020 2.00 ± 0.50	0.531 ± 0.039 13.50 ± 1.00	0.827 ± 0.039 21.00 ± 1.00	2.362 ± 0.039 60.00 ± 1.00	0.630 ± 0.004 16.00 ± 2.00	7.008 ± 0.004 178.00 ± 2.00	inches mm

Packaging Specifications – Paper Tape



Type/Code	A	B	W	E	F	Unit
FRC0402	0.028 ± 0.004 0.70 ± 0.10	0.047 ± 0.004 1.20 ± 0.10	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
FRC0603	0.041 ± 0.008 1.05 ± 0.20	0.071 ± 0.008 1.80 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
FRC0805	0.061 ± 0.008 1.55 ± 0.20	0.091 ± 0.008 2.30 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
FRC1206	0.075 ± 0.008 1.90 ± 0.20	0.138 ± 0.008 3.50 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
FRC1210	0.112 ± 0.008 2.85 ± 0.20	0.138 ± 0.008 3.50 ± 0.20	0.315 ± 0.008 8.00 ± 0.20	0.069 ± 0.004 1.75 ± 0.10	0.138 ± 0.002 3.50 ± 0.05	inches mm
Type/Code	G	H	T	D	P	Unit
FRC0402	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.018 ± 0.004 0.45 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.079 ± 0.004 2.00 ± 0.10	inches mm
FRC0603	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.024 ± 0.004 0.60 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
FRC0805	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.030 ± 0.004 0.75 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
FRC1206	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.030 ± 0.004 0.75 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm
FRC1210	0.157 ± 0.004 4.00 ± 0.10	0.079 ± 0.002 2.00 ± 0.05	0.030 ± 0.004 0.75 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.157 ± 0.004 4.00 ± 0.10	inches mm

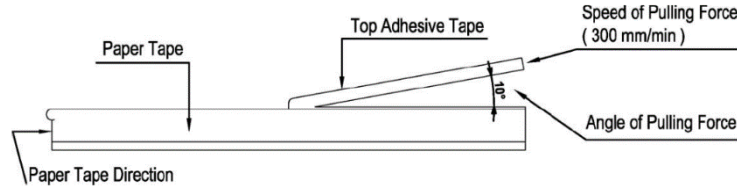
Packaging Specifications – Plastic Tape



Type/Code	A	B	W	E	F	G	Unit
FRC2010	0.110 ± 0.008 2.80 ± 0.20	0.220 ± 0.008 5.60 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	inches mm
FRC2512	0.134 ± 0.008 3.40 ± 0.20	0.264 ± 0.008 6.70 ± 0.20	0.472 ± 0.004 12.00 ± 0.10	0.069 ± 0.004 1.75 ± 0.10	0.217 ± 0.002 5.50 ± 0.05	0.157 ± 0.004 4.00 ± 0.10	inches mm
Type/Code	H	T	D	D1	T1	P	Unit
FRC2010	0.079 ± 0.002 2.00 ± 0.05	0.009 ± 0.004 0.23 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.033 ± 0.006 0.85 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm
FRC2512	0.079 ± 0.002 2.00 ± 0.05	0.009 ± 0.004 0.23 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.059 ± 0.004 1.50 ± 0.10	0.033 ± 0.006 0.85 ± 0.15	0.157 ± 0.004 4.00 ± 0.10	inches mm

Peel Force of Top Cover Paper Tape

The peel force of top cover tape shall be between 10 ~ 70 g.

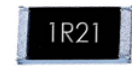


Part Marking Instructions

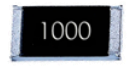
E96 and E24 Values for 0805-2512 (1% tolerance)

The nominal resistance is marked on the surface of the overcoating with the use of **four character markings**.

1. Values <100Ω will use "R" as the decimal holder.



1.21Ω



100Ω

E24 Values for 0603-2512 (5% tolerance)

The nominal resistance is marked on the surface of the overcoating with the use of **three character markings**.

1. Values between 1Ω and 9.1Ω will use "R" as the decimal holder.



1Ω

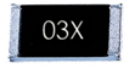


1.2 KΩ

E96 Values for 0603 size (1% tolerance)

A two character number is assigned to each standard R-Value (E96) as shown in the chart below. This is followed by one alpha character which is used as a multiplier.

Each letter from "Y" - "F" represents a specific multiplier.



10.5Ω

Alpha Character = Multiplier		Chip Marking = Value	
Y = 0.1	A = 10	01Y = 10.0 x 0.1 = 1Ω	
X = 1	B = 100	01B = 10.0 x 100 = 1KΩ	

E96											
#	R-Value	#	R-Value	#	R-Value	#	R-Value	#	R-Value	#	R-Value
01	10.0	17	14.7	33	21.5	49	31.6	65	46.4	81	68.1
02	10.2	18	15.0	34	22.1	50	32.4	66	47.5	82	69.8
03	10.5	19	15.4	35	22.6	51	33.2	67	48.7	83	71.5
04	10.7	20	15.8	36	23.2	52	34.0	68	49.9	84	73.2
05	11.0	21	16.2	37	23.7	53	34.8	69	51.1	85	75.0
06	11.3	22	16.5	38	24.3	54	35.7	70	52.3	86	76.8
07	11.5	23	16.9	39	24.9	55	36.5	71	53.6	87	78.7
08	11.8	24	17.4	40	25.5	56	37.4	72	54.9	88	80.6
09	12.1	25	17.8	41	26.1	57	38.3	73	56.2	89	82.5
10	12.4	26	18.2	42	26.7	58	39.2	74	57.6	90	84.5
11	12.7	27	18.7	43	27.4	59	40.2	75	59.0	91	86.6
12	13.0	28	19.1	44	28.0	60	41.2	76	60.4	92	88.7
13	13.3	29	19.6	45	28.7	61	42.2	77	61.9	93	90.9
14	13.7	30	20.0	46	29.4	62	43.2	78	63.4	94	93.1
15	14.0	31	20.5	47	30.1	63	44.2	79	64.9	95	95.3
16	14.3	32	21.0	48	30.9	64	45.3	80	66.5	96	97.6

Note: 0402 resistors are not marked.

RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

RoHS Compliance Status						
Standard Product Series	Description	Package / Termination Type	Standard Series RoHS Compliant	Lead-Free Termination Composition	Lead-Free Mfg. Effective Date (Std Product Series)	Lead-Free Effective Date Code (YY/WW)
FRC	Fusible Thick Film Chip Resistor	SMD	YES ⁽¹⁾	100% Matte Sn over Ni	Always	Always

Note (1): RoHS Compliant by means of exemption 7c-I.

"Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

Environmental Policy

It is the policy of Stackpole Electronics, Inc. to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

How to Order

F	R	C	0	8	0	5	F	T	1	R	0	0
Product Series		Size		Tolerance		Packaging		Resistance Value				
Code	Description	Size	W	Code	Tol	Value	Code	Description	Size	Quantity	Four characters with the multiplier used as the decimal holder.	
FRC	Fusible	0402	0.063	F	1%	E24	T	7" Reel - Paper Tape	0402	10000		
		0603	0.1	J	5%	E96		7" Reel - Plastic Tape	0603, 0805, 1206, 1210	5000	1 ohm = 1R00	
		0805	0.125						2010, 2512	4000	10 ohm = 10R0	
		1206	0.25								1 Kohm = 1K00	
		1210	0.5									
		2010	0.75									
		2512	1									