

Part Marking Instructions – Chip Resistors



1% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 4 digit markings.
0201 and 0402 are not marked.



5% Marking
The nominal resistance is marked on the surface of the overcoating with the use of 3 digit markings.
0201 and 0402 are not marked.

For shared E24/E96 values, 1% tolerance product may be marked with three digit marking instead of the standard four digit marking for all other E96 values. All E24 values available in 1% tolerance are also marked with three digit marking. Standard HVC is unmarked.

Mark Instructions for 0603 1% Chip Resistor (EIA-J)

A two-digit 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 as follows:

Y = 0.1	B = 100	E = 100,000
X = 1	C = 1,000	F = 1,000,000
A = 10	D = 10,000	

EXAMPLE:

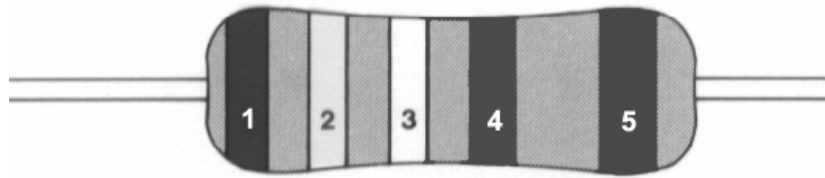
Chip Marking	Explanation	Value
01B	01 means 10.0 and B = 100	10.0 x 100 = 1 K ohm
25C	25 means 17.8 and C = 1,000	17.8 x 1,000 = 17.8 K ohm
93D	93 means 90.9 and D = 10,000	90.9 x 10,000 = 909 K ohm

E96											
1%	#	1%	#	1%	#	1%	#	1%	#	1%	#
10.0	01	14.7	17	21.5	33	31.6	49	46.4	65	68.1	81
10.2	02	15.0	18	22.1	34	32.4	50	47.5	66	69.8	82
10.5	03	15.4	19	22.6	35	33.2	51	48.7	67	71.5	83
10.7	04	15.8	20	23.2	36	34.0	52	49.9	68	73.2	84
11.0	05	16.2	21	23.7	37	34.8	53	51.1	69	75.0	85
11.3	06	16.5	22	24.3	38	35.7	54	52.3	70	76.8	86
11.5	07	16.9	23	24.9	39	36.5	55	53.6	71	78.7	87
11.8	08	17.4	24	25.5	40	37.4	56	54.9	72	80.6	88
12.1	09	17.8	25	26.1	41	38.3	57	56.2	73	82.5	89
12.4	10	18.2	26	26.7	42	39.2	58	57.6	74	84.5	90
12.7	11	18.7	27	27.4	43	40.2	59	59.0	75	86.6	91
13.0	12	19.1	28	28.0	44	41.2	60	60.4	76	88.7	92
13.3	13	19.6	29	28.7	45	42.2	61	61.9	77	90.9	93
13.7	14	20.0	30	29.4	46	43.2	62	63.4	78	93.1	94
14.0	15	20.5	31	30.1	47	44.2	63	64.9	79	95.3	95
14.3	16	21.0	32	30.9	48	45.3	64	66.5	80	97.6	96

Temperature Coefficient Codes			
Stackpole TC Code	MIL TC Code	Industry Std TC Code	Temperature Coefficient
M	N/A	-	±300 ppm/°C
L	N/A	T0	±200 ppm/°C
D	D	T1	±100 ppm/°C
C	C	T2	±50 ppm/°C
E	E	T9	±25 ppm/°C
S	N/A	T10	±15 ppm/°C
T	N/A	T13	±10 ppm/°C
Y	N/A	T16	±5 ppm/°C

Tolerance Codes		Resistance Values	
Stackpole/MIL Reference	Tolerance	Stackpole Standard for Nominal Values & Tolerances	
		Series	Tolerance
S	±40%	E12	±10%
N	±30%	E24	±5%, ±2%
M	±20%	E96	±1%
K	±10%	E192	±0.5%, ±0.25%, ±0.1%
J	±5%	Note: Non-standard ohmic values are available. Consult factory for minimum order quantities	
H	±3%		
G	±2%		
F	±1%		
D	±0.5%		
C	±0.25%		
B	±0.1%		
A	±0.05%		
T	±0.01%		

Component Flammability					
Product Type	Polymer Type	IEC 695-2-2	UL94V Rating	Total Polymer Mass	Oxygen Index
Carbon Films					
CF18 (CFM14)	Epoxy	Meets Specification	N/A	3 mg	N/A
CF14 (CFM12)	Epoxy	Meets Specification	N/A	15 mg	N/A
CF12	Epoxy	Meets Specification	N/A	30 mg	N/A
Metal Films					
RN18 (RNM14)	Epoxy	Meets Specification	N/A	3 mg	N/A
RN14 (RNM12)	Epoxy	Meets Specification	N/A	15 mg	N/A
RN12	Epoxy	Meets Specification	N/A	30 mg	N/A
Metal Oxides					
RSM12	Silicone	Meets Specification	94V-0	20 mg	46 - 48%
RSM1 (RS12)	Silicone	Meets Specification	94V-0	30 mg	46 - 48%
RSM2 (RS1)	Silicone	Meets Specification	94V-0	50 mg	46 - 48%
RSM3 (RS2)	Silicone	Meets Specification	94V-0	130 mg	46 - 48%
RSM5 (RS3)	Silicone	Meets Specification	94V-0	500 mg	46 - 48%
RS5	Silicone		94V-0	400 mg	46 - 48%
Chip Resistors					
RMC Series	Boro-Silicated Acid Lead Glass	Meets Specification	94V-0	N/A	N/A
Chip Networks					
RAC Series	Boro-Silicated Acid	Meets Specification	94V-0	N/A	N/A
RAV Series	Boro-Silicated Acid	Meets Specification	94V-0	N/A	N/A



Standard Color Codes			
Band Color	Nominal	Multiplier	Tolerance (%)
Black	0	1	-
Brown	1	10	1
Red	2	100	2
Orange	3	1K	-
Yellow	4	10K	-
Green	5	100K	0.5
Blue	6	1,000K	0.25
Violet	7	-	-
Gray	8	-	-
White	9	0.001	-
Silver	-	0.01	10
Gold	-	0.1	5

Color Band Description		
Band	Precision	General Purpose
	Have three significant-figure bands, a multiplier band and a tolerance band. Tolerances 1% or less.	Have two significant-figure bands, a multiplier band and a tolerance band. Tolerances 2% or greater.
1st Band	Nominal	Nominal
2nd Band	Nominal	Nominal
3rd Band	Nominal	Multiplier
4th Band	Multiplier	Tolerance
5th Band	Tolerance	

Resistor Glossary	
Term	Definition
Ambient temperature	The ambient temperature is the temperature in the immediate environment of the resistor.
Carbon-composition	Resistor with the resistance element formed by molding a body of carbon powder mixed with a phenolic binder.
Carbon-film	Resistor whose resistance element is carbon film deposited on a ceramic core.
Climate category	Indicates the lowest and the highest ambient temperature at which the resistors may be operated continuously.
Color-band or color code	Method of indicating value and tolerance on axial leaded resistors whose body is too small for legible alphanumerical marking.
Critical resistance	The critical resistance (R_{crit}) is the resistance that can be calculated from the rated dissipation P_v occurring under operating voltage V_{max} . A resistor of critical resistance will exhibit the largest drift in a style, because it is the highest value that may carry the full rated power load.
Current noise	Random low frequency electrostatic noise arising from current fluctuations in parallel with the resistor.
Current sensor	A resistive device employed to sense levels of changes in current.
Derating	The power load capability of a resistor is limited by its permissible element temperature. Since the rated power dissipation is referenced to a specific ambient temperature, higher ambient temperatures require a reduced permissible load, i.e., a derating. The derating curve indicates the permissible power load as a function of the ambient temperature.
Dielectric strength (dielectric withstanding voltage)	The ultimate breakdown voltage of the dielectric or insulation of the resistor when the voltage is applied between the case and all terminals tied together. Dielectric strength is usually specified at sea level and simulated at high altitude air pressures.
DIP	Dual-in-line package resistor network.
E-series	Method of deriving nominal resistance values required for each tolerance level. The series E24 is comprised of 24 values per decade and applies to 2% and 5% tolerances. The series E96 applies to 1% tolerance and E192 applies to 0.1%, 0.25% and 0.5%.
Failure rate	The failure rate indicates the statistically established maximum rate of failures at a level of confidence of 60%. The figures are derived from certified results of standard endurance tests after 1000 hours duration at the rated dissipation.
Film temperature	The temperature of the resistive film is considered in discussions about power rating and pulse load capability. The film temperature determines the drift and stability of the resistor. For resistors that feature hot spots in the resistive film, the higher temperature of the hot spot is to be considered. Since most resistors are covered with lacquer or protective coating, only the surface temperature can be measured on the outside. However, the surface temperature is almost as high as the film temperature.
Fixed resistors	Resistors whose value is set in the manufacturing process.
Insulation resistance	The DC resistance measured between all terminals connected together and the case, exterior insulation, or external hardware.
Kelvin connection	Four-terminal connection required in low-resistance measurements to eliminate the effects of contact resistance and lead resistance, as well as the effects of lead temperature, providing accurate measurements. Invented by Lord Kelvin in the 19th Century.

Resistor Glossary	
Term	Definition
Maximum working voltage	The maximum voltage stress (DC or rms) that may be applied to the resistor (resistance element). A function of the materials used, the required performance, and the physical dimensions.
Metal oxide	Resistor whose resistance element is a thick film ruthenium oxide paste deposited on a cylindrical ceramic core by means of dipping or spiral-coating.
Operating voltage	The limiting element voltage V_{max} is the maximum voltage that may be applied continuously to the resistor, provided its resistance value is equal to or higher than the critical resistance. The limit applies to DC voltages and to AC rms voltage of undistorted sinusoidal shape.
Power rating	Maximum power in still air that will limit the resistor internal hot-spot temperature to a satisfactory level. Power ratings must be reduced as the temperature rises, so derating curves or charts are published. These parameters are application-dependent.
Pulse load capability	The pulse load capability of a resistor is its ability to withstand transient loads that considerably exceed the rated dissipation with its peak value.
Resistance temperature characteristic (coefficient)	The magnitude of change in resistance due to temperature, expressed in percent or degree centigrade or parts-per-million per degree centigrade (PPM/C). If the resistance changes are linear over the specified temperature range, the parameter is known as the temperature "coefficient". This assumption of linearity is usually made in order to ease calculations.
Resistance tolerance	The permissible deviation of the manufactured resistance value (express in percent) from the specified nominal resistance value at standard or stated environmental conditions.
Resistor	A device that converts electrical energy to thermal energy according to Ohm's Law.
Shunt	A resistive device employed to divert most of the current in an electric circuit.
SIP	Single-in-line package resistor network.
SMD	Surface mount devices. Chips and chip arrays are examples.
Solderability	Property of the termination to accept new solder in a soldering process.
Stability	Ability of a resistor to maintain its initial resistance value of extended periods of time when subjected to any combination of electrical stresses and environmental conditions.
Temperature rise	Thermal resistance that impedes the dissipation of heat from the resistor.
Thick-film	Resistor whose resistance element consists of a ruthenium oxide (also called cermet) screen printed onto a ceramic substrate and fired at a high temperature.
Variable resistors	Resistors whose value can be adjusted (trimmed) by the user, typically by means of a dial.
Voltage coefficient	A resistor has a voltage coefficient if measurements of resistance with different voltages yield different results. The voltage coefficient is the quotient of the relative difference in resistance and the difference of measuring voltage.
Wirewound	Resistor whose resistance element consists of a wire (nickel-chromium, copper-nickel, or gold-platinum) wound around a bobbin or core.
Zero-ohm resistors	Jumpers that are manufactured into resistor bodies for ease of insertion by the user.

EIA Standard Resistor Values

Codes for fixed resistors

STANDARD RESISTANCE VALUES FOR THE 10 TO 100 DECADE

(also usable in decade multiples or sub-multiples)

Resistance Tolerance (%)																															
E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6	E192	E96	E24	E12	E6							
0.10%	0.25%	0.50%	1%	2%	5%	10%	20%	0.10%	0.25%	0.50%	1%	2%	5%	10%	20%	0.10%	0.25%	0.50%	1%	2%	5%	10%	20%	0.10%	0.25%	0.50%	1%	2%	5%	10%	20%
10.0	10.0	10	10	10	15.8	15.8	-	-	-	24.9	24.9	-	-	-	39.2	39.2	39	39	-	62.6	-	-	-	-	62.6	-	-	-	-	-	
10.1	-	-	-	-	16.0	-	16	-	-	25.2	-	-	-	-	39.7	-	-	-	-	63.4	63.4	-	-	-	63.4	-	-	-	-	-	
10.2	10.2	-	-	-	16.2	16.2	-	-	-	25.5	25.5	-	-	-	40.2	40.2	-	-	-	64.2	-	-	-	-	64.2	-	-	-	-	-	
10.4	-	-	-	-	16.4	-	-	-	-	25.8	-	-	-	-	40.7	-	-	-	-	64.9	64.9	-	-	-	64.9	64.9	-	-	-	-	
10.5	10.5	-	-	-	16.5	16.5	-	-	-	26.1	26.1	-	-	-	41.2	41.2	-	-	-	65.7	-	-	-	-	65.7	-	-	-	-	-	
10.6	-	-	-	-	16.7	-	-	-	-	26.4	-	-	-	-	41.7	-	-	-	-	66.5	66.5	-	-	-	66.5	66.5	-	-	-	-	
10.7	10.7	-	-	-	16.9	16.9	-	-	-	26.7	26.7	-	-	-	42.2	42.2	-	-	-	67.3	-	-	-	-	67.3	-	-	-	-	-	
10.9	-	-	-	-	17.2	-	-	-	-	27.1	-	27	27	-	42.7	-	-	-	-	68.1	68.1	68	68	68	68.1	68.1	68	68	68	68	
11.0	11.0	11	-	-	17.4	17.4	-	-	-	27.4	27.4	-	-	-	43.2	43.2	43	-	-	69.0	-	-	-	-	69.0	-	-	-	-	-	
11.1	-	-	-	-	17.6	-	-	-	-	27.7	-	-	-	-	43.7	-	-	-	-	69.8	69.8	-	-	-	69.8	69.8	-	-	-	-	
11.3	11.3	-	-	-	17.8	17.8	-	-	-	28.0	28.0	-	-	-	44.2	44.2	-	-	-	70.6	-	-	-	-	70.6	-	-	-	-	-	
11.4	-	-	-	-	18.0	-	18	18	-	28.4	-	-	-	-	44.8	-	-	-	-	71.5	71.5	-	-	-	71.5	71.5	-	-	-	-	
11.5	11.5	-	-	-	18.2	18.2	-	-	-	28.7	28.7	-	-	-	45.3	45.3	-	-	-	72.3	-	-	-	-	72.3	-	-	-	-	-	
11.7	-	-	-	-	18.4	-	-	-	-	29.1	-	-	-	-	45.9	-	-	-	-	73.2	73.2	-	-	-	73.2	73.2	-	-	-	-	
11.8	11.8	-	-	-	18.7	18.7	-	-	-	29.4	29.4	-	-	-	46.4	46.4	-	-	-	74.1	-	-	-	-	74.1	-	-	-	-	-	
12.0	-	12	12	-	18.9	-	-	-	-	29.8	-	-	-	-	47.0	-	47	47	47	75.0	75.0	75	-	-	75.0	75.0	75	-	-	-	
12.1	12.1	-	-	-	19.1	19.1	-	-	-	30.1	30.1	30	-	-	47.5	47.5	-	-	-	75.9	-	-	-	-	75.9	-	-	-	-	-	
12.3	-	-	-	-	19.3	-	-	-	-	30.5	-	-	-	-	48.1	-	-	-	-	76.8	76.8	-	-	-	76.8	76.8	-	-	-	-	
12.4	12.4	-	-	-	19.6	19.6	-	-	-	30.9	30.9	-	-	-	48.7	48.7	-	-	-	77.7	-	-	-	-	77.7	-	-	-	-	-	
12.6	-	-	-	-	19.8	-	-	-	-	31.2	-	-	-	-	49.3	-	-	-	-	78.7	78.7	-	-	-	78.7	78.7	-	-	-	-	
12.7	12.7	-	-	-	20.0	20.0	20	-	-	31.6	31.6	-	-	-	49.9	49.9	-	-	-	79.6	-	-	-	-	79.6	-	-	-	-	-	
12.9	-	-	-	-	20.3	-	-	-	-	32.0	-	-	-	-	50.5	-	-	-	-	80.6	80.6	-	-	-	80.6	80.6	-	-	-	-	
13.0	13.0	13	-	-	20.5	20.5	20	-	-	32.4	32.4	-	-	-	51.1	51.1	51	-	-	81.6	-	-	-	-	81.6	-	-	-	-	-	
13.2	-	-	-	-	20.8	-	-	-	-	32.8	-	-	-	-	51.7	-	-	-	-	82.5	82.5	82	82	-	82.5	82.5	82	82	-	-	
13.3	13.3	-	-	-	21.0	21.0	-	-	-	33.2	33.2	33	33	33	52.3	52.3	-	-	-	83.5	-	-	-	-	83.5	-	-	-	-	-	
13.5	-	-	-	-	21.3	-	-	-	-	33.6	-	-	-	-	53.0	-	-	-	-	84.5	84.5	-	-	-	84.5	84.5	-	-	-	-	
13.7	13.7	-	-	-	21.5	21.5	-	-	-	34.0	34.0	-	-	-	53.6	53.6	-	-	-	85.6	-	-	-	-	85.6	-	-	-	-	-	
13.8	-	-	-	-	21.8	-	-	-	-	34.4	-	-	-	-	54.2	-	-	-	-	86.6	86.6	-	-	-	86.6	86.6	-	-	-	-	
14.0	14.0	-	-	-	22.1	22.1	22	22	22	34.8	34.8	-	-	-	54.9	54.9	-	-	-	87.6	-	-	-	-	87.6	-	-	-	-	-	
14.2	-	-	-	-	22.3	-	-	-	-	35.2	-	-	-	-	55.6	-	-	-	-	88.7	88.7	-	-	-	88.7	88.7	-	-	-	-	
14.3	14.3	-	-	-	22.6	22.6	-	-	-	35.7	35.7	-	-	-	56.2	56.2	56	56	-	89.8	-	-	-	-	89.8	-	-	-	-	-	
14.5	-	-	-	-	22.9	-	-	-	-	36.1	-	36	-	-	56.9	-	-	-	-	90.9	90.9	91	-	-	90.9	90.9	91	-	-	-	
14.7	14.7	-	-	-	23.2	23.2	-	-	-	36.5	36.5	-	-	-	57.6	57.6	-	-	-	92.0	-	-	-	-	92.0	-	-	-	-	-	
14.9	-	-	-	-	23.4	-	-	-	-	37.0	-	-	-	-	58.3	-	-	-	-	93.1	93.1	-	-	-	93.1	93.1	-	-	-	-	
15.0	15.0	15	15	15	23.7	23.7	-	-	-	37.4	37.4	-	-	-	59.0	59.0	-	-	-	94.2	-	-	-	-	94.2	-	-	-	-	-	
15.2	-	-	-	-	24.0	-	24	-	-	37.9	-	-	-	-	59.7	-	-	-	-	95.3	95.3	-	-	-	95.3	95.3	-	-	-	-	
15.4	15.4	-	-	-	24.3	24.3	-	-	-	38.3	38.3	-	-	-	60.4	60.4	-	-	-	96.5	-	-	-	-	96.5	-	-	-	-	-	
15.6	-	-	-	-	24.6	-	-	-	-	38.8	-	-	-	-	61.2	-	-	-	-	97.6	97.6	-	-	-	97.6	97.6	-	-	-	-	
															61.9	61.9	62	-	-	98.8	-	-	-	-	98.8	-	-	-	-	-	