1.4 Colour Coding and Type Designation

Non-precision capacitors and resistors are marked by coloured bands or dots to indicate their *nominal value* (in pF and ohms respectively) and their tolerance. When the tolerance is not specifically indicated it is usually ±20% – that is, the actual resistance value may differ from the nominal value by as much as ±20%. The standard colour code is shown in Table 1.2.

Example A resistor of nominal value 150 Ω and no tolerance coding may actually have a resistance anywhere between 120 Ω and 180 Ω, (i.e. 150 Ω – 20% to 150 Ω + 20%)

Colour	Significant Figure	Decimal Multiplier	Tolerance in Percent†	Temperature Coefficient (ppm/°C)	MIL or RETMA Class
Black	0	1	±20	0	A
Brown	1	10	± 1	- 30	B
Red	2	10^2	± 2	- 80	C
Orange	3	10^3		-150	D
Yellow	4	10^4		-220	E
Green	5	10^5	± 5*	-330	F
Blue	6	10^6		-470	
Violet	7	10^7		-750	
Gray	8	0.01*	±10*	+30	
White	9	0.1*			
Gold	-	0.1	± 5		
Silver	-	0.01	±10		
No Colour	-	-	±20		

Note:* Alternative coding where metallic pigments are undesirable.

For capacitors smaller than 10 pF, tolerance percentages should be multiplied by 0.1 to give the tolerance in pF.

Table 1.2 Electronics Industry Colour Code

Figure 1.1 shows the arrangement of coloured bands and dots on fixed resistors and capacitors. It will be seen that in addition to indicating nominal value and tolerance, these colours are also used on capacitors to indicate their temperature coefficients

or variations of capacitance with temperature, and their MIL† or RETMA characteristic. The MIL or RETMA characteristic refers to a specification describing limits for dielectric losses, capacitance drift, temperature coefficient and insulation resistance. These specification classes are labeled A, B, C . . . F, and the colour code for these letters is given in Table 1.2.

Ceramic capacitors may be used for temperature compensation in certain applications, and under these circumstances the temperature coefficient for the component must be known to the user. Just as there are preferred component values, so are there preferred temperature coefficient values. Again there are tolerances on these nominal temperature coefficients just as there are tolerances on nominal component values. However, the tolerance on temperature coefficient is not shown in the colour code for the capacitor. Such detailed information is given in the component type designation. Information pertaining to specifications, temperature coefficient and type designation will be found in Reference [1] given at the end of this chapter while table 1.3 shows the letter codes used for some of the specifications applied to fixed capacitors. An example of type designation follows this table.

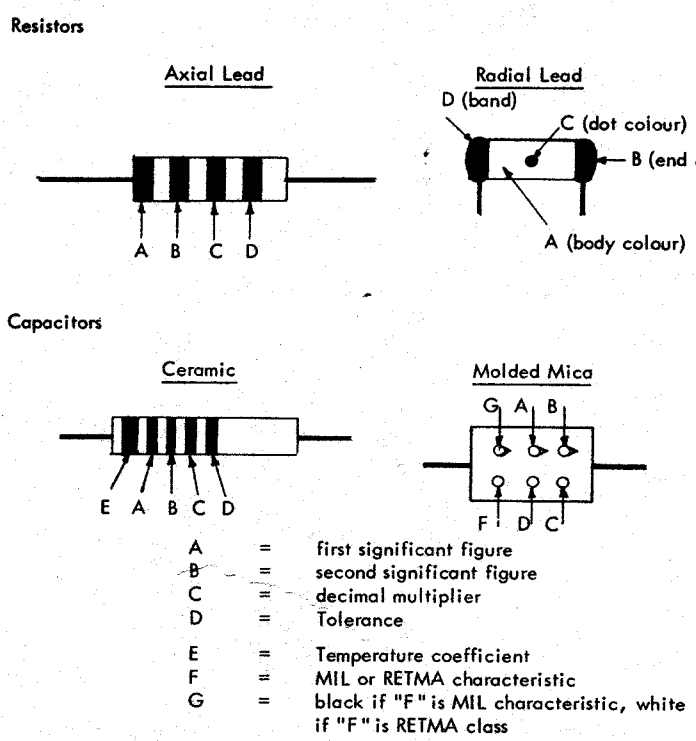

Figure 1.1 Arrangement of Component Colour Coding

† U.S. Military Specification

1.4.1 Colour Coding Examples

	A	B	C	D	
Resistor	red	red	brown	silver	220 ohms ± 10%
Resistor	brown	green	yellow	–	150 k ohms ± 20%
Capacitor	red	red	brown	black	220 pf ± 20%
Capacitor	blue	gray	white	black	6.8 pf ± 2 pf

Letter	Characteristic Value			
	Tolerance %	Tolerance pF	Temp. Coeff. ppm/°C	Temp. Coeff. Tolerance ppm/°C
B		±0.1		
C		±0.25	0	
D		±0.5		
F	±1	±1		±15
G	±2	±2		±30
H			−30	±60
J	±5			±120
K	±10			±250
L			−80	±500
M	±20			
P			−150	
R			−220	
S			−330	
T			−470	
U			−750	

Table 1.3 Letter Codes Used in Type Designations

1.4.2 Type Designation Example

Type designation CC32UJ271J

Interpretation

CC	=	ceramic capacitor
32	=	case size code, 0.225″ diam. X 0.860″ length
U	=	temperature coeff. = −750 ppm/°C
J	=	temp. coeff. tolerance = ± 120 ppm/°C
27	=	significant figures for capacitance (pF)
1	=	decimal exponent for capacitance
J	=	capacitance tolerance = ± 5%

This component is therefore a ceramic capacitor, with a nominal value of 270 pF ±5%, and a temperature coefficient of −750 ± 120 ppm/°C (i.e. temp. coeff. may lie between −630 ppm/°C and −870 ppm/°C).