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VERSION	EFFECTIVE DATE	DESCRIPTION OF REVISION(S)
001	2014.08	Module creation and release.
002	2016.10	Format Updates
003	2017.03	Content updates and subject clarification.
004	2019.07	Fine tuned Submodule content sequence based on Appendix-A. Updated layout and styling.
004.1	2020.06	Corrected equations on parallel AC circuits and resonance, page 14.5 and 14.7.
004.2	2023.04	Inclusion of Measurement Standards for clarification, page iv. Minor appearance and format updates.
005	2024.04	Regulatory update for EASA 2023-989 compliance.
005.1	2025.09	Revised Figure 16-10, Figure 17-6 and Figure 17-8.
005.2	2026.08	Submodule 9: Added data table to Figure 9-10.

Color	Digit 1	Digit 2	Multiplier	Tolerance		Voltage
Black	0	0	1	+/– 20%	+/– 2.0 pF	100
Brown	1	1	10	+/– 1%	+/– .1 pF	200
Red	2	2	100	+/– 2%	+/– .25 pF	300
Orange	3	3	1 000	+/– 3%	-	400
Yellow	4	4	10 000	+/– 4%	-	500
Green	5	5	100 000	+/– 5%	+/– .5 pF	600
Blue	6	6	Not Used	-	-	700
Violet	7	7	Not Used	-	-	800
Grey	8	8	.01	+80%; -20%	-	900
White	9	9	.1	-	+/– 1.0 pF	1 000

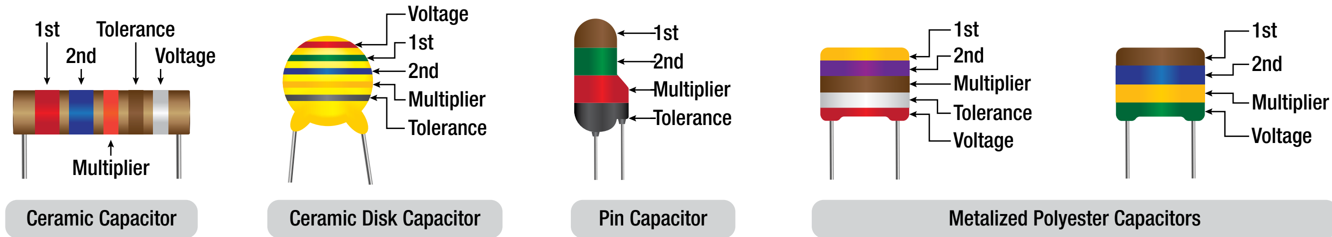

Figure 9-10. Identification key for capacitor color coding.

VARIABLE CAPACITORS

Variable capacitors are mostly used in radio tuning circuits, and they are sometimes called "tuning capacitors." They have very small capacitance values, typically between 100pF and 500pF.

TRIMMERS

The trimmer is actually an adjustable or variable capacitor, which uses ceramic or plastic as a dielectric. Most of them are color coded to easily recognize their tunable size. The ceramic type has the value printed on them. Colors are: yellow (5pF), blue (7pF), white (10pF), green (30pF), and brown (60pf).

VARACTORS

A voltage variable capacitor or varactor is also known as a variable capacitance diode or a varicap. This device utilizes the variation of the barrier width in a reversed biased diode. Because the barrier width of a diode acts as a nonconductor, a diode forms a capacitor when reversed biased. Essentially the N type material becomes one plate and the junctions are the dielectric. If the reversed bias voltage is increased, then the barrier width widens, effectively separating the two capacitor plates and reducing the capacitance.

CAPACITOR COLOR CODING

The values of Capacitance, Voltage or Tolerance are generally marked onto the body of the capacitors in alphanumeric characters. However, when the value of the capacitance is a decimal, problems arise as decimal point could easily not be noticed resulting in a misreading of the actual value. Instead letters such as 'p' (pico) or 'n' (nano) are used in place of the decimal point to identify its position and the weight of the number.

For example, a capacitor can be labeled as, n47 = 0.47nF, 4n7 = 4.7nF, or 47n = 47nF, and so on. Sometimes capacitors are marked with the capital letter 'K' to signify a value of one thousand picofarads. A capacitor with the markings of 100K would be 100 × 1000pF or 100nF. To reduce this confusion, an international color coding scheme was developed as a simple way of identifying values and tolerances. It consists of colored bands (in spectral order) known as the Capacitor Color Code system and whose meanings are illustrated in **Figure 9-10**.

CALCULATIONS OF CAPACITANCE

CAPACITORS IN SERIES

When capacitors are placed in series, the effective plate separation is increased and the total capacitance is less than that of the smallest capacitor. Additionally, the series combination is capable of withstanding a higher total potential difference than any of the individual capacitors. **Figure 9-11** is a simple series circuit. The bottom plate of C_1 and the top plate of C_2 will be charged by electrostatic induction. The capacitors charge as current is established through the circuit. Since this is a series circuit, the current must be the same at all points. Since the current is the rate of flow of charge, the amount of charge (Q) stored by each capacitor is equal to the total charge.

$$Q_T = Q_1 + Q_2 + Q_3$$

According to Kirchhoff's voltage law, the sum of the voltages across the charged capacitors must equal the total voltage, ET. This is expressed as:

$$E_T = E_1 + E_2 + E_3$$

Equation $E = {}^{Q}/_{C}$ can now be substituted into the voltage equation where we now get:

$$\frac{Q_T}{C_T} = \frac{Q_1}{E_1} + \frac{Q_2}{E_2} + \frac{Q_3}{E_3}$$