SOME USEFUL FACTS . . .

OHM'S LAW

$E = IR$ $\quad P = EI$

$R = E/I$ $\quad P = E^2/R$

$I = E/R$ $\quad P = I^2R$

E = Voltage (Volts)
R = Resistance (Ohms)
I = Current (Amperes)
P = Power (Watts)

SERIES RESISTANCE

$$R_{total} = R_1 + R_2 + R_3 \ldots R_n$$

REACTANCE FORMULAS

Capacitive: $X_C = \dfrac{1}{2\pi fC}$

Inductive: $X_L = 2\pi fL$

TEMP. COEFF. OF RESISTANCE

$\%\Delta R = (T_a + T_R - 25°C)(TC)$

T_a = Equipment Ambient Temp. °C

T_R = Resistor Avg. Temp. Rise Due To Power °C

TC = TCR in %/°C (Convert from PPM/°C)

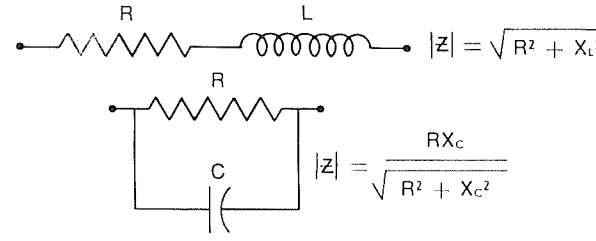
PARALLEL RESISTANCE

$$R_{total} = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots \frac{1}{R_n}}$$

2 RESISTORS IN PARALLEL

$$R_t = \frac{R_1 R_2}{R_1 + R_2}$$

IMPEDANCE FORMULAS



RESISTOR DESIGN TOLERANCE—A STATISTICAL METHOD

$T_n = (\Sigma X \pm \sqrt{\Sigma\sigma^2}) \pm X_t$

T_n = Design Tolerance in $\%\Delta R$

X_t = Purchase Tolerance

ΣX = Sum of Mean $\%\Delta R$'s for given environmental parameters

$\Sigma\sigma^2$ = Sum of squared std. deviations from mean for same environmental parameters

PPM/°C TO %ΔR/°C CONVERSION

(PER DEGREES C)

1 ppm	10 ppm	25 ppm	50 ppm	100 ppm	200 ppm	500 ppm	1000 ppm
.0001%	.001%	.0025%	.005%	.01%	.02%	.05%	0.1%

SURGE CALCULATIONS BASED ON STANDARD POWER RATINGS

Single Square Wave

$J = Pt$ $\quad P = \dfrac{E^2}{R}$

P = Power (in watts)
E = Voltage (in volts)
R = Resistance (Ohms)
t = Pulse duration (seconds)
J = Energy (watt-seconds or joules)

Capacitor Discharge Circuit

$J = \dfrac{CE^2}{2}$

C = Capacitance (farads)
E = Voltage (volts)
J = Energy (watt-sec.)

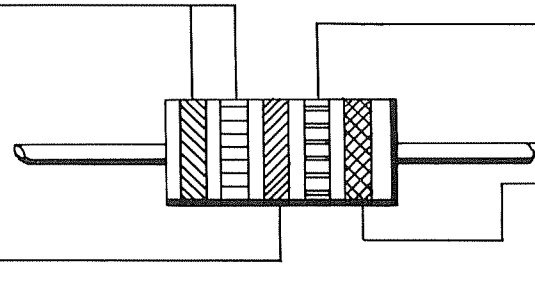
RESISTOR CLASSIFICATIONS*

GEN. PURPOSE	SEMI PRECISION	PRECISION	ULTRA PRECISE	POWER	HIGH VOLTAGE/HIGH Ω
±5, 10, 20%	±1, 2%	±0.5, 1%	±0.1% or less	2 TO 250W	TO 100KV, 100GΩ
Carbon Composition	Metal Glaze™	Metal Film	Bulk Property	Wirewounds	Carbon Composition
Metal Glaze™	Deposited Carbon	Metal Glaze™	Metal Film	Metal Film	Carbon Alloy
Molded Wirewounds	TaNFilm™ Networks	TaNFilm™ Networks		Metal Glaze™	Thick Film
GP ¼ Metal Film	Thick Film Networks				

*SEE PAGE 1 FOR PRODUCT INDEXES FOR THESE CLASSIFICATIONS.

COLOR CODE FOR FIXED RESISTORS

SIGNIFICANT FIGURES		MULTIPLIER
0	= Black =	1
1	= Brown =	10
2	= Red =	100
3	= Orange =	1000
4	= Yellow =	10,000
5	= Green =	100,000
6	= Blue =	1,000,000
7	= Violet =	10,000,000
8	= Gray =	100,000,000
9	= White =	1,000,000,000
—	= Silver =	0.01
—	= Gold =	0.1



TOLERANCE

Brown = 1%
Red = 2%
Gold = 5%
Silver = 10%
No Band = 20%

RELIABILITY LEVEL*

Brown = 1.0% (M)
Red = 0.1% (P)
Orange = 0.01% (R)
Yellow = 0.001% (S)

* MIL-R-39008 resistors only

FILM resistors used for general-purpose and semiprecision (RL) applications have two significant-figure bands, a multiplier band, a tolerance band, and a final white band to indicate that leads can be soldered. Precision (RN) and low-resistance units are available with either color bands or alphanumeric printing. If banded, these resistors have three significant-figure bands, a multiplier band, and a tolerance band.

WIREWOUND resistors have a double-width first band. A final blue band indicates the unit is recognized by Underwriters Laboratories as failsafe under Document 492.2.