

# EE 49

# Electronics for IoT

Electronics – Circuits

# Batteries



# Examples of Resistor Package, Lead, and Mounting Styles

## Carbon & Metal Film



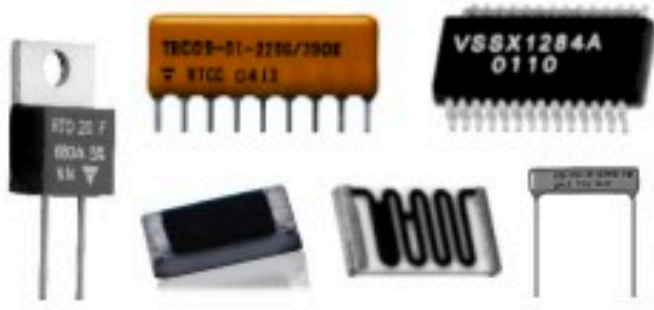
## Wire-Wound



## Adjustable



## Thick Film



## Special-Purpose



## Thin Film



Compilation by  
www.RFCafe.com

Examples provided by Radio Shack (radioshack.com) and Vishay (vishay.com) websites

<http://www.rfcafe.com/references/electrical/resistance.htm>

# Resistor Applications

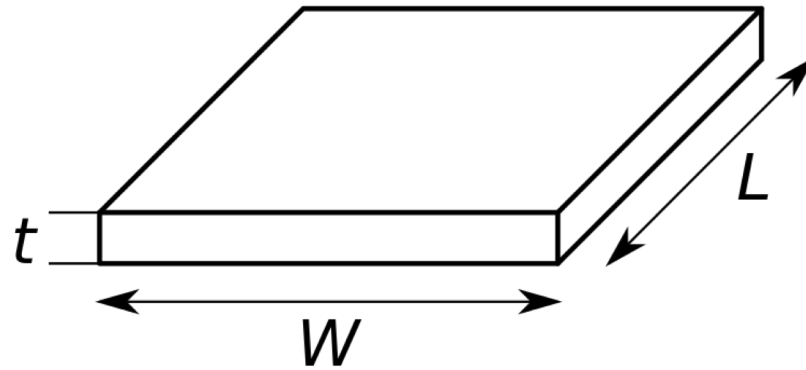
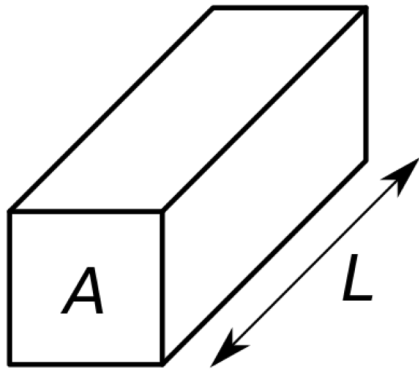
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# Resistivity

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[https://en.wikipedia.org/wiki/Sheet\\_resistance](https://en.wikipedia.org/wiki/Sheet_resistance)

Material	Resistivity, $\rho$ ( $\Omega\cdot\text{m}$ )
Superconductors	0
Metals	$10^{-8}$
Semiconductors	Variable
Electrolytes	Variable
Insulators	$10^{16}$
Superinsulators	$\infty$

Material	Resistivity $\rho$ ( $\Omega \cdot \text{m}$ ) at 20 °C	Conductivity $\sigma$ (S/m) at 20 °C	Temperature coefficient <sup>[a]</sup> ( $\text{K}^{-1}$ )	Reference
Silver	$1.59 \times 10^{-8}$	$6.30 \times 10^7$	0.0038	[21][22]
Copper	$1.68 \times 10^{-8}$	$5.96 \times 10^7$	0.00404	[23][24]
Annealed copper <sup>[b]</sup>	$1.72 \times 10^{-8}$	$5.80 \times 10^7$	0.00393	[25]
Gold <sup>[c]</sup>	$2.44 \times 10^{-8}$	$4.1 \times 10^7$	0.0034	[21]
Aluminium <sup>[d]</sup>	$2.65 \times 10^{-8}$	$3.77 \times 10^7$	0.0039	[21]
Calcium	$3.36 \times 10^{-8}$	$2.98 \times 10^7$	0.0041	
Tungsten	$5.60 \times 10^{-8}$	$1.79 \times 10^7$	0.0045	[21]
Zinc	$5.90 \times 10^{-8}$	$1.69 \times 10^7$	0.0037	[26]
Nickel	$6.99 \times 10^{-8}$	$1.43 \times 10^7$	0.006	
Lithium	$9.28 \times 10^{-8}$	$1.08 \times 10^7$	0.006	
Iron	$9.7 \times 10^{-8}$	$1 \times 10^7$	0.005	[21]
Platinum	$1.06 \times 10^{-7}$	$9.43 \times 10^6$	0.00392	[21]
Tin	$1.09 \times 10^{-7}$	$9.17 \times 10^6$	0.0045	

# Strain Gauge

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