**Harold’s DC Circuits**

**Cheat Sheet**

11 October 2025

**Circuit Laws**

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| **Circuit Law** | **Formula** |
| **Kirchhoff’s Current Law (KCL)** | $$\sum\_{i=1}^{n}I\_{i}=0$$$$I\_{in1}+I\_{in2}=I\_{out1}+I\_{out2}+I\_{out3}$$ |  |
| The total current flowing into a node or junction must equal the total current flowing out of the node or junction.(conservation of charge) |
| **Kirchhoff’s Voltage Law (KVL)** | $$\sum\_{i=1}^{n}V\_{i}=0$$$$V\_{1}=V\_{2}+V\_{3}+V\_{4}+V\_{5}+V\_{6}$$ |  |
| The sum of all voltages around a circuit loop is equal to zero.(conservation of energy) |
| **Ohm’s Law** | $$V=IR$$ | A circular diagram of electrical symbols  Description automatically generated with medium confidence |
| **Power** | $$P=VI$$$$P=I^{2}R$$$$P=\frac{V^{2}}{R}$$$$P=\frac{W}{t}$$ | An across (V) times a through (I) variable.$$Watt (W)=\frac{Volt (V)}{Ampere (A)}$$ |
| **Electrical Energy** | $$E=QV$$$$E=VIt$$$$P=I^{2}Rt$$$$E=Pt$$ | $$Joule \left(J\right)=\frac{Watt \left(W\right)}{second \left(s\right)}$$ |

**Components**

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Battery** | **Ground** | **Current Source** |
| **Component** | Arduino misconceptions 6: a 9V battery is a good power source | The mystery of the 3 prong cord - Air ... | CS580 Current Source |
| **Symbol** | Battery Symbol | Ground Symbol Clip Art at Clker.com - vector clip art online, royalty free  & public domain | Ammeter Symbol Symbol |
| **Denoted by** | $$V$$ | $$GND$$ | $$I$$ |
| **Units** | V (Volt) | $$0 V$$ | A (Ampere) |
| **Series** | $$V\_{EQ}=V\_{1}+V\_{2}$$ | NA | $$I\_{EQ}=I\_{1}+I\_{2}$$ |
| **Parallel** | $$V\_{1}=V\_{2}=V\_{3}$$ | NA | $$I\_{EQ}=I\_{1}+I\_{2}$$ |

|  |  |  |  |
| --- | --- | --- | --- |
| **Element** | **Resistor** | **Capacitor** | **Inductor** |
| **Component** | Close-up of a resistor  AI-generated content may be incorrect. | Toshin Kogyo 220μF Electrolytic Capacitor 63V dc, Radial, Through Hole -  1JUTSJ221M0 | A close up of a coil  AI-generated content may be incorrect. |
| **Symbol** | Vector clip art of RSA electronics capacitor symbol | Public domain vectors | A black symbols with a plus and a curved line  AI-generated content may be incorrect. | A black line with a white background  AI-generated content may be incorrect. |
| **Denoted by** | $$R$$ | $$C$$ | $$L$$ |
| **Units** | Ω (Ohm) | F (Farad) | H (Henry) |
| **Equation** | $$R=\frac{V\_{R}}{I}$$ | $$C=\frac{Q}{V\_{C}}$$ | $$L=\frac{V\_{L}}{\left(\frac{di}{dt}\right)}$$ |
| **Series** | A diagram of a circuit  AI-generated content may be incorrect. | A diagram of a circuit  AI-generated content may be incorrect. | A diagram of a circuit  AI-generated content may be incorrect. |
| $$R\_{T}=R\_{1}+R\_{2}+R\_{3}$$ | $$\frac{1}{C\_{T}}=\frac{1}{C\_{1}}+\frac{1}{C\_{2}}+\frac{1}{C\_{3}}$$ | $$L\_{T}=L\_{1}+L\_{2}+L\_{3}$$ |
| **Parallel** | A diagram of a circuit  AI-generated content may be incorrect. | A math equation with numbers and symbols  AI-generated content may be incorrect. | A diagram of a circuit  AI-generated content may be incorrect. |
| $$\frac{1}{R\_{T}}=\frac{1}{R\_{1}}+\frac{1}{R\_{2}}+\frac{1}{R\_{3}}$$ | $$C\_{T}=C\_{1}+C\_{2}+C\_{3}$$ | $$\frac{1}{L\_{T}}=\frac{1}{L\_{1}}+\frac{1}{L\_{2}}+\frac{1}{L\_{3}}$$ |

**Electrical Symbols**



**Sources**

* Electrical Technology (2020 Oct). Resistance, Capacitance & Inductance in Series-Parallel – Equation & Formulas. <https://www.electricaltechnology.org/2020/10/resistance-inductance-capacitance-series-parallel-formulas.html>
* ForumElectrical.Com (2025). Electrical Symbols. <https://forumelectrical.com/basic-electric-symbols/>
* LibreTexts Physics (2024). 9.6: Electrical Energy and Power. [https://phys.libretexts.org/Bookshelves/University\_Physics/University\_Physics\_(OpenStax)/University\_Physics\_II\_-\_Thermodynamics\_Electricity\_and\_Magnetism\_(OpenStax)/09%3A\_Current\_and\_Resistance/9.06%3A\_Electrical\_Energy\_and\_Power](https://phys.libretexts.org/Bookshelves/University_Physics/University_Physics_%28OpenStax%29/University_Physics_II_-_Thermodynamics_Electricity_and_Magnetism_%28OpenStax%29/09%3A_Current_and_Resistance/9.06%3A_Electrical_Energy_and_Power)
* Tech Web (2024). Resonant Circuits: Resonant Frequency and Q Factor. <https://techweb.rohm.com/product/power-device/si/18332/>